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VIEWS, NEWS AND INTERVIEWS.

The telephone cable running from the Battery to Governor's Island parted the other day, probably because some craft ran afoul of it. Three men were sent out from the Battery in a rowboat to grapple for the broken ends. They were unable to raise them. Then one of the men, Leon Cholet, who is an expert diver, put on a bathing suit and vanished under water, nearly 25 feet. He made a line fast to one of the broken ends and it was hauled up. He came up for a breathing spell, and then went down and got the other end. The ends were spliced and the repaired cable was lowered to the river bottom.

Mashonaland natives, who are now fighting the British, are pulling down the African transcontinental telegraph wires and cutting them up into bullets.

M. Bergonie, of Bordeaux, has recently made some researches into the action of the X rays upon the progress of pulmonary tuberculosis. The patients were laid out on beds, and the surface of the skin being covered with a light covering, the Crookes tube was placed over the affected region at a distance of 20 centimeters. The exposures lasted for 10 minutes and resulted in no injury to the skin. In five of the patients only was the treatment persevered with. In two of these, where acute phthisis chanced to be aggravated by the results of alcoholism and poor living, there was no improvement whatever either in the general or the local conditions. Three chronic cases of pulmonary tuberculosis showed some amelioration of general condition, but no alteration at the seat of mischief and no arrest of the disease. In three other cases the rays had no appreciable action. The bacillus of Koch seems not to have been modified in its behavior, an observation which was supported recently at the Biological Society by M. Blaise, who read a note affirming that the X rays had absolutely no action whatever upon microbic cultures.

A press dispatch states that a franchise has been granted to the Hon. Irvine Howebart and associates to construct an electric line between Colorado Springs, Colo., and Cripple Creek, a distance of 30 miles. The franchise also empowers the new railroad to obtain its power from the water system of Colorado Springs. The power will be generated by the fall of water in coming down in pipes from the Beaver lakes, the headwaters of the city system, located on Pike's Peak, at an altitude of 12,000 feet. The city's water will be protected from contamination. Mr. Howebart is in Europe floating the bonds necessary for the construction of the road, which will cost $1,500,000. Work on grading has begun. The proposed road will have grades in places as high as 13½ per cent.

This advertisement recently appeared in a Dundee, Scotland, paper:

"Man wanted to attend Cows, and work Electric Light, and make himself generally useful. Married man with no (or small) family preferred.—Apply," etc.

A fine of $25 was recently imposed by Justice Van Wart in the Second District Civil Court, Williamsburgh, on the Nassau Electric Railroad Company, of Brooklyn, N. Y., for a violation of the fender ordinance. The action was begun several months ago by the city through the Corporation Counsel as a test case.

French Customs Officer Inspecting a Woman's Hat and Hair by Means of X-Ray Apparatus.

French Customs Officer Examining a Hand-Satchel by Means of X-Ray Apparatus.

"LA LORGNETTE HUMAINE."

AN X-RAY DEVICE IN USE BY THE FRENCH CUSTOMS AUTHORITIES.

The Electrical Review some weeks ago mentioned the fact that the French customs officers were experimenting with an X-ray apparatus designed to detect dutiable articles concealed about the clothing of a traveler or in sealed packages. The accompanying illustrations show this apparatus in an improved form devised by Prof. Gaston Sèguy and which recently underwent successful tests at the Pavillon de Rohan and the Gare du Nord. The apparatus consists of a square case of the dimensions of an ordinary soap box, with a sliding front, upon which rests the Crookes tube holder. Inside the case is the accumulator, from which, by a single turn of a knob, the electric current passes through insulated wires into the tube, thus producing the rays.

The "lorgnette humaine," or fluorescent stereoscope, through which, in the illustrations herewith, one of the individuals is seen peering, constitutes the most important feature of Professor Sèguy's improvement. With the aid of this simple device the

examination of objects by means of the X-ray apparatus in broad daylight is accomplished without difficulty. The operator adjusts the stereoscope to his eyes in any light, and the objects placed between the fluorescent screen at the base of his holder and the Crookes tube become as clear and visible as if the room were entirely darkened. These advantages have been made clear to the French Government, and have led to the adoption of the machine for various purposes.

The chief advantage of the "lorgnette humaine" is that it simplifies the application of the X ray to the extent of permitting the general use of Professor Roentgen's discovery without the trouble and expense heretofore attendant upon all experiments of the kind. One of its most important *rôles* will be in the customs service. That is clear, from the fact that the bulk of the Paris experiments, both in the office of the chief of the French customs, Monsieur Pallaiu, and at the Gare du Nord, were undertaken with a view to ascertaining the value of the invention as applied to the inspection of baggage and merchandise. The photographs published here illustrate the various phases of these tests. In one picture we see the inspection of a woman's hat and hair — favorite hiding-places for jewelry, diamonds, etc., among the smuggling fraternity; a second picture shows us the method of inspecting hand-satchels, which also applies to all kinds of baggage.

The tests disclosed the presence of all metallic objects, gems, tobacco and cigars, and even of numerous textile fabrics, fine laces and brocades. It was shown that with the help of the "lorgnette humaine" certain adulterations of wines and liquors could be readily detected; also the quality of certain dyed silks. Finally —and this is of some importance, in this age of bombs and dynamite—it was ascertained that an infernal machine, no matter how constructed, would not resist the all-revealing light, but would at once surrender its grim secret under its irresistible spell!

The custom-house inspector will no longer trample roughshod on our feelings. He will disappear forever, and in his place will come a mild and innocuous personage with something that looks like an opera-glass in his hand. If you have told the truth and have nothing to declare, this newcomer will just take a fluorescent peep at your belongings and disappear from view like a fleeting shadow.

We are indebted to *Leslie's Weekly* for the above particulars and the engravings illustrating this interesting apparatus.

Work on the immense dam in Trowbridge township, Mich., will soon begin and will probably give work to 200 men. The projector, Charles Frisbie, of Jackson, says there will be built one of the largest electric plants in the State to generate power for factories and lighting. The dam will be 300 feet long and 20 feet high. The flowage land consists of about 1,000 acres and cost Mr. Frisbie $25,000.

Electricity in Garvin's Machine Shop.

The adaptation of electric motors for power purposes as made by the Garvin Machine Company in the new "Garvin" Building, New York city, is excellent, in as much as each of the eight floors used for power have motors operating independently of the others. By this arrangement the usual heavy losses of power in factories as the result of much belting and shafting is avoided. Motors of the Crocker-Wheeler type of 30 horse-power are used, and power is generated near the factory. Altogether 11 motors are used in the building.

Last year this company suffered the destruction by fire of their entire building on Laight street, and the new

THE "GARVIN" BUILDING, NEW YORK.

structure at Spring and Varick streets is one of the most modern and complete establishments, which is exclusively used by a mechanical company, of any in the world. The building, which is of handsome gray stone, eight stories in height, covering an entire block, is equipped throughout with every facility for producing the line of machines and machine tools made by this company. The show rooms on the ground floor are very commodious and take in the entire area. Every modern convenience has been installed, including a telephone system of 26 stations, and call bells connecting all departments. The offices are on the second floor in front, and include several suites of handsome private rooms reserved for members of the firm, which adjoin the main offices for the various clerical departments. Two freight and one passenger elevator, run by electricity, are in constant use, and also an excellent electric light system. The company employs in these shops 450 men.

A recent trolley party, under the leadership of Senator George F. Hoar, made a round trip from Boston to Gloucester, Mass., a distance of nearly 75 miles.

THE ECONOMY AND UTILITY OF ELECTRICAL COOKING APPARATUS.

READ AT THE FOURTEENTH GENERAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, ELIOT, ME., JULY 26-28, 1897, BY JOHN PRICE JACKSON.

The tests of electrical cooking apparatus detailed in this paper were made with the hope of obtaining a method of cooking that would be satisfactory with a minimum risk of fire. During the past Winter a serious fire, which might readily have become disastrous, occurred in one of the buildings of the college with which the writer is connected, caused by the use of an alcohol stove. As this institution is lighted and furnished with power by electricity, it was naturally felt that such a danger should be avoided, if possible, by the use of electrical appliances. It was also desired to find out whether at least a portion of the cooking in the woman's department of the college could not be done satisfactorily by electricity.

To settle these points, I procured from the American Electrical Heating Corporation, of Boston (through the courtesy of Mr. Sayles), the following pieces of apparatus:

One oven, 12 inches by 9 inches by 15 inches, having three heats, 3, 10 and 17 amperes respectively.

Three stoves of 2, 4 and 5 amperes respectively.

Two flatirons of 1.5 and 6 amperes capacity.

One broiler of 12 amperes capacity.

The pressure used by these is 110 volts.

The stoves are round disks of iron, on the under side of which the heating wires are embedded in a non-conducting, non-combustible compound. The oven is a box, so thoroughly heat-insulated that the outside metal covering never reaches a temperature uncomfortable to the hand. The broiler is made of a corrugated metal surface, slightly tipped from the horizontal, with a drip groove at the lower edge for catching the meat juices. The flatirons are similar in construction to the stoves, the larger one having a low heat switch, which enables the operator to control the heat.

In all these appliances the heating coils are so arranged that the energy is largely concentrated at useful points. They are also supplied with supports and cases which will not conduct heat.

The efficiencies of the two larger stoves were obtained by heating two pounds of water to the boiling point and measuring the power supplied by a calibrated wattmeter. The cooking vessels used were ordinary stewing pans, with the bases nearly the same size as the tops of the stoves. The efficiencies, considering the ratio between the amount of heat absorbed by the water and the amount received by the stove, were:

For the larger, or No. 1, 48.9 per cent.

For the next size, No. 2, 43.1 per cent.

These efficiencies could be increased by having the pans made to fit the stoves exactly, and still further by carefully covering the pans, lids and exposed portions of the stoves with a non-conductor of heat.

When it is desired to boil water, the best plan is to place an immersion coil in a properly heat-insulated pot; such an arrangement should give an efficiency of from 90 to 100 per cent. We unluckily did not have such a coil at our disposal.

It was impossible to measure the cooking efficiency of the oven, but as it was merely warm on the outside after potatoes or bread had been baked and "done to a turn," the efficiency is high. In baking, the current was turned on and the oven allowed to heat for five minutes before the articles to be cooked were placed within, and the current was turned off from 10 to 20 minutes before the baking was done, when the heat of the oven was sufficient to complete the operation. The broiler was manipulated in much the same manner, thus utilizing the greatest possible amount of heat. This electrical apparatus was used in cooking most of the meals for a family of six for several weeks.

The following table indicates the amount of cooking done for the first breakfast, dinner and supper, respectively, and may be taken as a fair average of the whole period.

All costs have been estimated on the basis of 10 cents per kilowatt hour, the average rate charged for residence electrical supply in a nearby town. The foods were not measured, as it was believed more desirable to determine whether in a long period of cooking the apparatus would prove satisfactory in a family of given size.

The largest stove is designated No. 1; the next size, No. 2; the third size, No. 3; the broiler, B, and the oven, O.

BREAKFAST.

Time	Utensils	Food	Watts
6.55	No. 1, on	Rolled oats....	
6.55	No. 2, on	Coffee.....	844
7.45	No. 2, off		
7.45	No. B, on	Beefsteak.....	1,500
7.55	No. 2, off	.....	1,155
8.05	No. B, off		

Kilowatt hours, 1.355; cost, 13.55 cents.

DINNER.

10.25	No. O, on	Beef Roast	
10.35		Potatoes..	1,610
11.14		Pie.....	
11.46	No. 1, on	Asparagus....	1,990
12.05	No. O, off		
12.05	No. 2, on	Coffee.....	1,180
12.11	No. B, on	Toast for Aspar.	2,200
12.29	No. 1, off	.....	1,835
12.32	No. B, off		
12.32	No. 2, off		

Kilowatt hours, 2.98; cost, 29.8 cents.

SUPPER.

4.59	No. 1, on	Cocoa.....	630
5.15	No. 2, on	Potato cakes	1,010

Time	Utensils	Food	Watts
5.10	No. B, on	Omelet	2,100
5.22	No. 2, off		1,700
5.26	No. B, off		
5.26	No. 2, on		1,130
5.43	No. 2, off		
5.44	No. 1, off		640

Kilowatt hours, 8.39; cost, 8.39 cents.

Four pies can be baked in the oven at an expenditure of .62 kilowatt hour and a cost of 6.2 cents, or 2.05 cents per pie. Two large loaves of bread were baked with the current on the oven 50 minutes, at an expenditure of 1.22 kilowatt hour, a cost of 12.2 cents, or 6.1 cents per loaf. Four rather small-sized loaves could have been as readily baked; biscuits with about the same expenditure of energy as in the case of pies. The broiler utilized about the same amount of energy for all kinds of meat as indicated in the table.

Sales Room in Garvin Building.

The result of the whole series of meals was a cost for electricity of 13.1 cents per meal. The heating of water for washing the dishes took an additional .35 of a kilowatt hour per meal, which raises the cost to 16.6 cents per meal.

To determine the relative cost of cooking with electricity and coal, the same foods were cooked on the No. 8 Othello coal stove ordinarily used by the family. The coal was carefully weighed. The results gave an average of 12.6 pounds per meal, which at $5 per ton gives a cost of 3.15 cents per meal.

The result shows the cost of cooking by coal about 19 per cent of the cost of cooking by electricity.

Ironing was done for the same household a number of times. The heavy articles were done with the large iron; while for fancy dresses and small articles, the small iron was used. The average time taken was four hours, and the expenditure of energy in kilowatt-hours was 2.27. This made the cost of the ironing 22.7 cents.

An equal number of tests was made using the coal range, the fuel being carefully weighed. For the same size wash, the ironing took five hours, at a cost of 12.25 cents. This shows the cost of energy by the use of coal to be 54 per cent of that by electricity.

The results of the cooking tests seem to indicate that for the ordinary cooking of a family for the whole year, the expense would be larger than would be ordinarily acceptable, notwithstanding the great advantages in other respects. However, in the following classes their utility should be great:

1. For light housekeeping, such as is practiced in small city apartments, or in many larger houses during the Summer months, no other method presents so many desirable features. The dirt of coal and ashes, disagreeable gases, and abnormal temperatures due to a coal stove are entirely obviated. For such housekeeping a disk stove using 500 or 600 watts and a broiler using about 1,200 watts would be sufficient for a small family and would cost from $20 to $30. A teakettle or immersion coil might be added at a cost of from $6 to $10. A special pair of wires would of necessity have to be run into the cooking room from the house or apartment supply mains. The latter would ordinarily warrant the extra call that would be made upon them in this way. For similar purposes coal oil, gas or gasoline are frequently used, but with the inherent disadvantages of greater heat in the room, offensive odors, comparative uncleanliness and danger.

2. This form of cooking apparatus could be used with facility in boarding-houses and restaurants for purposes which require an even temperature such as is needed in baking griddle cakes, boiling eggs, etc.

3. Where electricity is available, nothing could be more convenient than a small electrical stove, requiring 300 or 400 watts, for the many uses to which at present the alcohol flame is put, such as the afternoon teakettle, chafing-dish, toaster, etc. This use of alcohol is most unsafe as regards danger from fire, and could well be discarded for electricity, which is absolutely safe when properly installed, as well as being more convenient and better in other respects.

4. In the shop, the glue-pot, solder-pot, brazing-iron, etc., can be heated advantageously by electricity, and one of the most gratifying consequences of our experiments has been the decision to put such an equipment in our college shops.

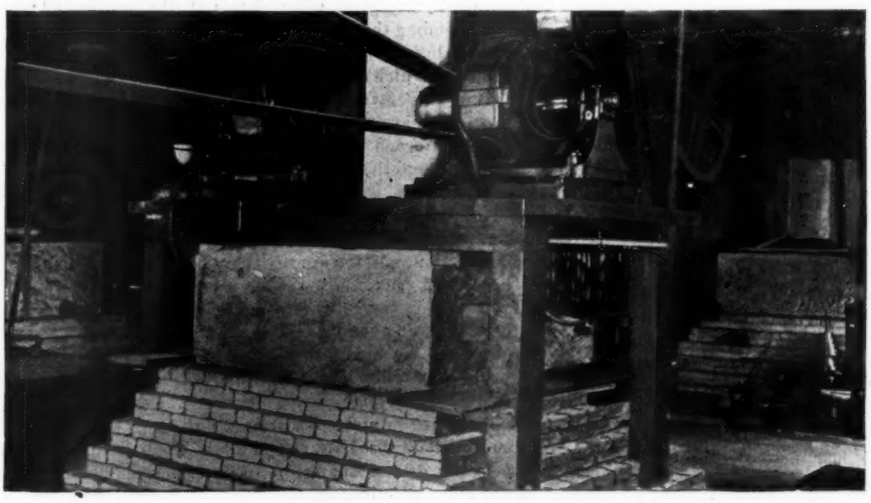
5. The test of the electrical flat-irons showed them more economical than the old form, when the saving of labor is taken into account. Not only is there a saving in time, but the severity of labor is much lessened. Our experience was that a laundress who had used an electrical iron would be exceedingly unwilling to go back to the old form.

A small flat-iron of two or three amperes attached to the ordinary lighting fixture in a dressing-room is a great convenience, and, with an electric tea-kettle and curling-iron, are destined to become essentials in the modern home.

Concerning the questions whether the use of electricity had proved satisfactory in its operations in the cooking tests described, the housekeeper in charge said: "The instruments were excellent in every respect. We were able to cook more rapidly, to keep the heat at just the right point, and could readily prevent over-cooking or under-cooking. While we were using electricity every dish was perfect. When I think of these advantages and of the cleanliness and convenience of the utensils, I sincerely hope that some of them at least may be retained in the house permanently."

The general results of the tests were of such a nature that the writer is warranted in the belief that if central station managers would more generally introduce exhibition equipments of these domestic utensils, a new call on their station capacity would develop, of which the larger proportion would be during the light-load periods.

I wish to acknowledge my indebtedness to Mr. Rudolph F. Kelker, of Harrisburg, Pa., for his valuable aid in carrying out the work briefly described above.



Motor Installation, Crocker-Wheeler Type, Used On Every Floor of the Garvin Factory.

ELECTRIC LIGHT FLASHES.

The incandescent electric light plant, foundry and machine shops of J. F. Enderton, of Aberdeen, Miss., were recently totally destroyed by fire. The loss was about $15,000, with only $2,000 insurance. The origin of the fire is unknown.

At the annual meeting of the Nashua, N. H., Light, Heat and Power Company, the following officers were elected: Directors, Fred W. Estabrook, Jas. H. Tolles, Frank E. Anderson, Geo. E. Anderson and David A. Gregg. At a subsequent meeting of the board it organized the election of F. W. Estabrook, president; F. E. Anderson, treasurer; Jas. H. Tolles, clerk.

There is more work in Topeka, Kas., now than men who can be secured to perform it. Several would-be employers are engaged in a hopeless search for workmen. F. E. Munsell, superintendent of the Edison Electric Illuminating Company, has had this fact demonstrated repeatedly. He has a lot of digging for the new heat mains, but can not obtain the necessary number of men.

The People's Electric Light and Power Company and the Newark Gas Company, of Newark, N. J., capital, $5,000,000, each controlling most of the lighting interests in Essex, Hudson, Bergen, Passaic and Union counties, New Jersey, have consolidated, with a capital of $15,000,000. The United Gas Improvement Company, of Philadelphia, is said to be behind the consolidation, and it is the purpose to ultimately consolidate all the gas and electric power companies of the State, with an aggregate capital of $50,000,000.

TWO CASES OF "ELECTRIC LIGHT BLINDNESS."

BY ROBERT HILL, SURGEON, ROYAL NAVY, H. M. S. "VICTORY," IN THE LONDON "LANCET."

I venture to forward for publication in the *Lancet* the following cases that have come under my notice lately, hoping that they may be of interest to its readers, and more especially to those engaged in ophthalmic work:

Case 1.—About 1 A. M. on June 1, 1897, I was called hurriedly to see a man who was said to be suffering great pain in his eyes. The man, a stoker, 20 years of age, I found walking round the sick bay of this ship in an agony of pain, with his hands up to his eyes, from which the tears were literally pouring. The lids were kept firmly closed, and all my efforts to see the eyes proved futile until I had dropped in cocaine, which acted like a charm. Five minutes later he could distinguish the number of persons in the room, but not the number of fingers held up. The pupils were moderately dilated (probably due to the cocaine); the palpebral conjunctiva was deeply congested, with but slight reddening of the bulbar conjunctiva; the cornea was clear. I imagined some irritant had been applied, but he denied this, nor could I find any trace of any substance, such as pepper, likely to cause the condition. Cold applications were used, and the patient soon fell asleep. At 8 A. M. his vision was normal, but the conjunctiva was injected, and he complained of a sticky sensation in his eyes. He then gave me the following history. When at work in H. M. S. "Mars" on the afternoon of May 31, he had stopped for about three minutes to look at the electric drill which was being used to bore holes in a steel plate, standing at a distance of from 10 to 12 yards; on resuming his own work everything appeared to him of a deep gold color, but he had no pain or lacrymation. He turned into his hammock at 9 P. M., and woke up in great pain at 12.30.

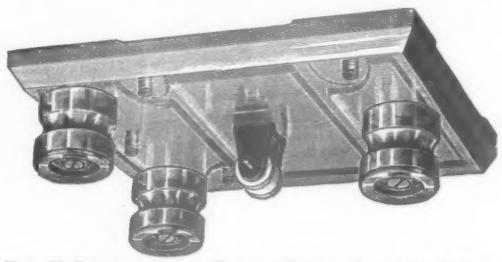
Case 2.—At 9 A. M. on June 1 a stoker, aged 28 years, who had been sleeping on shore, came to the sick bay complaining of his eyes; he stated that he had been working in H.M.S. "Mars" on the previous afternoon, and, like the patient in Case 1, had stopped to see the electric drill working, and had noticed during the remainder of the day that everything appeared of a deep gold color. About 4 A. M. he had jumped out of bed in great pain, and this had lasted about an hour and half. The condition of the eyes was very similar to that described in Case 1—injection of the conjunctiva being the only abnormal condition. Vision was normal.

Ever since the electric light has been in use workers at this trade have been subject to attacks of blindness, and cases have been recorded in which erosion of the cornea has followed the inflammation induced. Dark glasses are now always used by men so employed. The electric drill acts by fusing a hole through the steel, and probably the intensity of the light is greatly increased by the rays of light thrown off by the molten metal. The fact that the work is carried on chiefly in the daylight hides to a casual passer-by the extreme brilliancy of the light, and it is not until the patient experiences abnormal color sensations that he is aware of anything extraordinary. When first this drill was used in Chatham Dockyard, Surgeon P. N. Randall had a few similar cases among the dockyard hands, but as they slept on shore he had no opportunity of observing the acuteness of the pain.

The pathology of this condition has been stated to be similar to that of snow-blindness or desert blindness, and to depend on irritation of the branches of the ophthalmic division of the fifth nerve. In the cases above recorded the irritation would appear to have gone on to absolute paralysis and the pain to have been due to the acute congestion attending the nerves in their action of regaining their normal function. A somewhat analogous train of circumstances is found in the paralysis of the sensory nerves of other parts of the body when exposed to extreme cold, such as the ether spray or frost bite, and the pain in these cases is often very great when the congestion attending the "coming to" of the part takes place. The short period during which the severe pain lasted is also in favor of this analogy. The close sympathy that exists between the second nerve and the branches of the ophthalmic division of the fifth nerve is shown in many common and well known reflexes, such as lacrymation and sneezing on sudden exposure of the eye to a bright light, or, conversely, the dread of light that is caused by any injury to the cornea. In the class of cases described we have a marked instance of the first class of reflex. A temporary paralysis of some of the optic nerve terminals is induced by the exposure to the intense light and heat of the electric drill as shown by the subjective color sensations experienced. The corneal terminals reflexly share in the paralysis; lacrymation and photophobia are absent because the nerve terminals are paralyzed and not merely irritated at the time. After the lapse of a few hours a reaction with temporary congestion is set up as manifested by the acute pain and lacrymation, and probably some mistiness of vision. The longer the exposure to the bright light the profounder the paralysis and the more intense and lasting the reactionary symptoms. These cases are, in fact, analogous to snow-blindness, and, as in them, the pernicious effects of the electric light are probably due to the ultra violet rays of the spectrum.

The McDonald Glass Hanger-Board.

The insulation of appliances used in high-tension series arc lighting is always of the greatest importance, and particularly for inside arc-light wiring, where a dangerous voltage is carried into the building and directly to the lamp. A large number of arc-light hanger-boards have been designed from time to time having for their object better insulation, but it has remained for the McDonald glass hanger-board to secure the most striking results. As shown in the accompanying illustration, the hanger-board consists of glass insulating knobs mounted on a glass base or support. This secures a perfect insulation, which will always remain the same, as moisture or corrosion is not possible. This hanger makes a bright, clean appearance, and can always be kept in that condition. The extra holes shown in the base allow the board to be used with three insulators, as shown, or with only two insulators, one at each end of the board. When a series of lamps is being hung, the board at the end of the series may be used with two insulators, while all the other boards should be used with three insulators. Thus, when the wire reaches the first board, it is tied to the first of the two insulators at the double end; from this point a loop is made for the lamp, and the line wire leaves from the other insulator on the double end. This is repeated on each board of the series until the last board having only two insulators is reached. On this board the line goes first to the insulator at one end of the board, then through the lamp to the insulator at the other end. From this point it starts back out of the building, using as a support the free insulators on all of the boards having three insulating knobs. This makes a neat arrangement of the loops and, at the same time, a perfect insulation of both wires. The McDonald glass hanger-board is being placed on the market by the Electric Appliance Company, of Chicago.



THE MCDONALD GLASS HANGER-BOARD FOR ARC LAMPS.

The annual reports of the Union and Westchester electric railway companies, which are controlled by Albany, N. Y., capitalists, show: Union—Gross earnings from operation, $148,240; operating expenses, $85,720; net earnings, $62,520; other income, $416; gross income, $62,936; fixed charges, $32,611; net income, $30,325; cash on hand, $48,199; profit and loss (surplus), $328,675. Westchester Electric—Gross earnings from operation, $34,160; operating expenses, $22,680; net earnings, $11,480; fixed charges, $7,272; net income, $4,216; cash on hand, $1,368; profit and loss (deficiency), $8,321.

TELEPHONE NEWS AND COMMENT.

Alfred Buckman has been appointed manager of the Bell Telephone Company's office in Norwalk, Ohio, to succeed W. H. Harter, who was transferred to Montana.

The neglect of the Standard Telephone Company to commence work on its Camden, N. J., plant is said to be due to complications in Philadelphia. The franchise will probably be abandoned.

Teheran, Persia, is to have a telephone exchange, and a New York house is to supply the instruments. They will have to be carried 800 miles on the backs of mules to get to their destination after landing at Bushire.

The Bell Telephone Company, of Cincinnati, Ohio, or, as it is legally called, the City and Suburban Telegraph Association, is building a telephone line to Brookville, Ind., one of the most flourishing cities in that State. It will run via Hamilton, and will be completed in about four weeks. This will give merchants in Cincinnati an opportunity of reaching several of the best cities and villages in that territory.

The new State Telephone Company, of Detroit, Mich., has completed the purchase of all of that 225 miles of lines now under control of the Co-operative Telephone Company, of Lake Odessa. This company has exchanges in Lake Odessa and Grand Ledge, and its toll lines connect with the exchanges at Grand Rapids and Lansing. The purchase affords an entrance into Ionia, Lansing and Grand Rapids. Several other lines are begun, each of which will carry a traffic agreement with the Detroit Telephone Company.

The possible annexation of the Hawaiian Islands to the United States has aroused more than usual interest in that mid-sea republic. In an appreciative article on Hawaiian life, Mr. Richard Hamilton Potts writes as follows in *Harper's Weekly:*

"To all kinds of entertainment, formal or informal, one is bidden by the telephone—the telephone of a system complete, perfect, and as little inclined to hurry its messages as it ought to be consistently with the general order of things. To be cut off in the middle of a sentence is an aggravation almost unknown. Love-making, gossip, repartee, politics—everything goes through the telephone. Prudence is never learned, and everybody confides in 'Central' as if he were a fond parent."

The motion for injunction in the suit of Cahall vs. Babcock & Wilcox, for infringements of patents, has been decided in favor of the Babcock & Wilcox Company in the United States Court, Western District of Pennsylvania.

Electrical Features of the New Steamship "Bremen."

The steamship "Bremen" of the North German Lloyd line, which recently made her first transatlantic trip, is, perhaps, more fully equipped electrically than any other vessel of the merchant marine in the world. Aside from the usual electric lighting plant, she has a very complete and most novel power plant, the successful operation of which is now fully conceded.

The first power installations on the steamers of the North German Lloyd were made by the Union Electricitats Gesellshaft, of Berlin, the German ally of the General Electric Company, of Schenectady, N. Y., on the steamships "Darmstadt" and "Prinz Heinrich"; in these two cases the familiar and noisy donkey engines were superseded by electrically-operated winches, and it was the successful operation of these that determined the North German Lloyd to extend the use of electricity to the "Bremen." In this case, however, in lieu of winches, a full equipment

FIG. 3.—ELECTRIC CRANE CONTROLLER WITH UNIVERSAL GEAR.

of electric cranes was installed. These cranes are 16 in number, eight on the starboard side of the vessel and eight on the port side. Four of these have a capacity of 3,000 kilograms or 6,614 pounds, and 12 of 1,500 kilograms, or 3,307 pounds, and have a total swing outboard of 20½ feet.

The power generating plant is located in the after portion of the engine-room, and consists of four dynamos, each directly connected to its own engine. Two of these are placed on the starboard side and two on the port side. The dynamos have each a capacity of 75 kilowatts or 100 horse-power, and run at a speed of 210 revolutions per minute, delivering current at a pressure of 105 volts. The output of two dynamos is used for the cranes; one is used for the lighting of the ship, and the fourth dynamo is held in reserve in case of accident or other emergency. The engines are of the triple-expansion type, and were built by Schichau, of Elbing, near Danzig.

The most notable feature of the electrical equipment is the cranes, the lighting installation conforming to the standard practice. In designing the cranes, the principal requirements specified and obtained were as follows:

The load should be lifted smoothly; the resistance should be so arranged that the various speeds of the motors

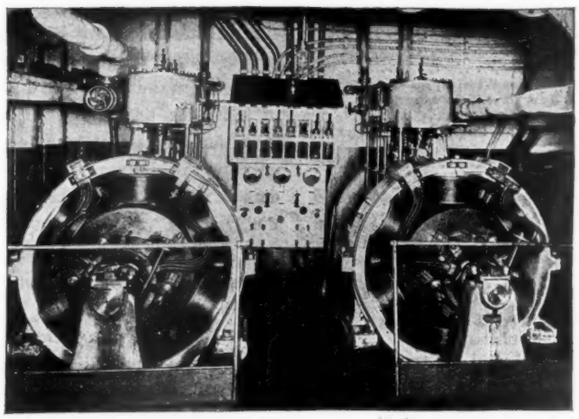


FIG. 1.—STARBOARD DYNAMOS, 75 KILOWATT EACH, STEAMSHIP "BREMEN."

should be obtained without too apparent and sudden change; the control of the different motions should be instantaneous and positive, these motions to be effected in the smallest possible space; the cranes to be compact and contain the smallest possible number of parts; the controlling mechanism to be of the simplest, to suit the class of operator likely to handle them; and the electrical apparatus to be absolutely protected against changes of weather, inroads of dust and sea water, and to be of such a nature as to withstand rough handling. In addition, all conductors were to be carefully protected, and the last consideration, but by no means the least, on a passenger-carrying steamer destined to be constantly loading and unloading, the operation of the cranes was to be noiseless. In conforming to these requirements, the Union Electricitats Gesellshaft has produced what is the latest and a very decided innovation in a ship's equipment.

The cranes, motor and controlling mechanism are mounted upon a circular iron platform which revolves upon a pivot. This is turned by a motor of seven horse-power running at 700 revolutions per minute, directly coupled to a worm gear, which in turn meshes in a gearing bolted to the deck. The loads are raised by a 25-horse-power series motor, running at a speed of 900 revolutions, and driving a special worm gear meshing into the gear of the drum. On the gear end of the drum shaft is fitted a winch head.

The controllers resemble a double

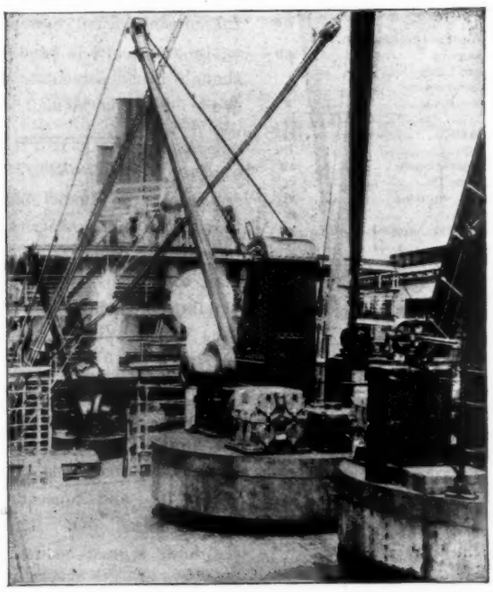


FIG. 2.—ELECTRIC CRANES ON THE STEAMSHIP "BREMEN."

street-car controller about two feet high. They are fitted with magnetic blow-out, any spark being immediately extinguished in a magnetic field. The contact cylinders are operated by a special mechanism actuated by a simple handle or lever, the movements of which correspond to the movements of the load. Raising the handle raises the load; depressing the handle lowers the load, and movement of the crane to the right or left is obtained by corresponding movements at the lever. Raising and swinging movements can be effected simultaneously. So simple are these operations that the dullest stevedore can handle these cranes with ease. Motors and controllers are water-tight and dust-tight, but the cases of both can readily be opened when necessary. To give a more perfect control, both motors are provided with band brakes, operated by the foot. These brakes are attached to an extension of the motor shaft.

The difference between the large and small cranes lies in the hoisting speed. Practically, both cranes are identical in electrical equipment, but the hoisting speed of the 3,000-kilogram crane at full load—60 feet per minute—is only half that of the 1,500-kilogram crane at full load—120 feet per minute. The movement of the jib of the cranes is 13 feet per second.

The most remarkable feature of the cranes, however, is the absolute noiselessness of their operation. During the visit paid by the writer of this to the vessel, the whole eight starboard cranes, four on the aft and four on the forward deck, were engaged in discharging cargo. Had the operation of hoisting and lowering not been witnessed, it would have been difficult to detect the fact, had it been necessary to depend upon the car. It is this feature that will recommend the electrical cranes to shipbuilders, especially those of passenger steamers, in such trades as that of the Mediterranean, where loading and discharging are effected at every port, and great credit is due the North German Lloyd Steamship Company for first effecting this great innovation.

Decision on Electric Car Heaters.

The United States Circuit Court of Appeals for the Second Circuit, on July 22 rendered an elaborate and sweeping decision, reversing the decree of the Circuit Court, which had granted to the Dewey Electric Heating Company an injunction against the Albany Railway Company, to prevent the use of the Consolidated Car-Heating Company's temperature regulating switch in connection with an indicating device, as being an infringement of the ninth claim of the Dewey patent No. 464,247. The court holds that this claim is entirely void for want of patentable invention, and this decision, it is said, finally settles the right of the Consolidated Car-Heating Company and its customers to use its temperature regulating switches with indicators, as the same have been and are now constructed.

LITERARY.

A midsummer fiction number is essential to a complete volume of any well regulated magazine, and August is the month in which the public most appreciates the lighter reading. But the *Home Magazine* "goes one better" with a bicycle fiction number for August.

Alex. R. Smith, secretary of the American Merchant Marine Association, contributes a timely paper to the August *North American Review* on "The Export Bounty Proposition." Mr. Smith expounds the purposes of those who advocate the payment by the government of an export bounty on agricultural staples, and points out that in equity the shipping interests of the country are no less entitled to national aid.

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EDITOR:
CHARLES W. PRICE.
ASSOCIATE EDITOR:
STEPHEN L. COLES.

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WESTERN OFFICE:
CARL E. KAMMEYER, Representative,
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LONDON OFFICE:
HENRY W. HALL, Representative,
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CHANGES for advertisements must be in this office by Friday noon for the following week's issue.

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NEW YORK, AUG. 11, 1897.

CONTENTS.

	PAGE
Views, News and Interviews	61
"La Lorgnette Humaine"	61
Electricity in Garvin's Machine Shop	62
The Economy and Utility of Electrical Cooking Apparatus	62
Electric Light Flashes	63
Two Cases of "Electric Light Blindness"	64
The McDonald Glass Hanger-Board	64
Telephone News and Comment	64
Electrical Features of the New Steamship "Bremen"	65
Literary	65
Prosperity	66
Tesla on the Source of Roentgen Rays and the Practical Construction and Safe Operation of Lenard Tubes	67
A New Form of Induction Coil	68
Electric Railway Notes	68
Professor Farmer's Experiment in Making Hardened Copper	69
A Case of Misplaced Confidence	69
Western Electric Company's Switches	69
The Relay and Its Relation to the Telegraphic Circuit	70
Personal	70
Suit on Battery Carbon Patents	70
An Electric Heater Decision	70
Electric Light Plant Wanted	71
Advance Information	72
Kindred Interests	ix
A Complete Enamel Rheostat Catalogue	ix
Electrical Patents	x
Tesla's System of Energy Transmission to a Distance Without Wires	x

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE
Abendroth & Root Mfg. Co., boilers	xvi
American Electrical Works, insulated wire	i
Babcock & Wilcox Co	xvi
Bogart, A. L	i
Brush Electric Co	ii
Bunnell & Co., J. H., dry batteries	i
C & C Electric Co	xvi
Clonbrock Steam Boiler Co	xvi
Columbia Incandescent Lamp Co	i
Crefeld Electrical Works	i
Crocker-Wheeler Electric Co	i
Day's Kerite, insulated wire	i, viii
Electric Appliance Co., supplies	i
Hampson, E. P., & Co., engines	xvi
Hill, Jr., Thos.	i
Imperial Porcelain Works	xvi
Iron Clad Rheostat Co	i
Leffel & Co., Jas	xvi
McKenney & Waterbury	i
New York & Ohio Co	i
New York Insulated Wire Co., Grimshaw wires and cables	i
Okonite Co., insulated wires and cables	i, xvi
Partridge Carbon Co., motor and generator brushes	i
Rodrigues, M. R	i
Stirling Co., water-tube boilers	xvi
Tabor & Mayer	i
Thayer & Co	i
Van Nuis, C. S	i

INSIDE PAGES.

	PAGE
American Bell Telephone Co	xiii
American Electric Telephone Co., long-distance telephones	vii, xiii
American Impulse-Wheel Co	viii
Andrews-Ryan Co., telephone engineers	xiii
Armorite Interior Conduit Co	xi
Automatic Circuit Breaker Co	xiv
B. & O. R. R	x
Baker & Co., platinum	xiv
Berlin Iron Bridge Co	iv
"Big Four" R. R	xii
Brill, J. G., Co	xiv
Brixey, W. R., Day's kerite wires and cables	viii
Buckeye Electric Co	v
Carborundum Co	iv
Central Electric Co., electrical supplies	iii
Chicago, Milwaukee & St. Paul Railway	xiv
Connecticut Pipe Mfg. Co	xiv
Correspondence School of Technology	viii
Crocker-Wheeler Electric Co	vii
Diehl Manufacturing Co	iii
Dixie Company	x
Dixon, Jos., Crucible Co., belt dressing	xiv
Duval, E. S., Jr., patents	x
Dyer & Driscoll, patent solicitors	x
Eastern Electric Cable Co	iv
Electrical Mercantile Agency	xi
Elwell-Parker Electric Co. of America	iv
Empire China Works, porcelain specialties	xiv
Eppenger & Russell Co., Valentine subway electrical conduit	xiv
Eyanson & Armpriester	vi
Faraday Carbon Co., carbons	iv
Farr Telephone & Construction Supply Co	xiii
Forest City Electric Co	vi
For Sale	viii
Fort Wayne Electric Corporation	vi
General Electric Co	vi
Gordon-Burnham Battery Co	xi
Hemingray Glass Co	iii
India Rubber and Gutta Percha Insulating Co	iv
International Correspondence Schools	ix
Jewell Belting Co	vi
Keystone Electrical Instrument Co	viii
Lehigh Valley Creosoting Co., creosoted lumber	xiv
Lockwood Long-Distance Telephone & Telegraph Co. of America	xiii
Lynn Incandescent Lamp Co	iii
Marshall, Wm., condensers	ix
McCaskey & Holcomb Co	ix
McIntire, C., Co	xi
Michigan Electric Co	xi
Midland Electric Co	viii
New England Engineering Co	vii
New York Telephone Co	ix
Novelty Electric Co., supplies	xiv
Orient Electrical Co	ix
Ostrander, W. R., & Co., supplies	xi
Pacific Electric Co	ix
Paiste, H. T., Co	xi
Partrick & Carter Co., electrical supplies for housework	ix
Phillips Insulated Wire Co., wire	viii
Ritchie, E. S., & Sons	ix
Royce & Marean, electrical supplies	xii
Safety Insulated Wire and Cable Co	iv
Sawyer-Man Electric Co	xi
Schiff, Jordan & Co	iii
Siemens & Halske Electric Co. of America	xii
Solor Carbon & Mfg. Co	xiii
Standard Thermometer & Electric Co	v
Stanley Electric & Mfg. Co., S. K. C	v
Sterling Supply & Mfg. Co	xiv
Viaduct Mfg. Co., telephones, etc	xii
Wabash Railroad Co	xiv
Wedderburn, John, & Co., patents	x
Western Electric Co	iv
Western Telephone Construction Co	xiii
Westinghouse Electric & Mfg. Co	vi
Weston Electrical Instrument Co., measuring instruments	viii
White & Co., J. G., engineers and contractors	ix
Willard Battery Co., storage batteries	ix
Williams-Abbott Electric Co	xiii

A Buffalo junk dealer recently stole 900 feet of live trolley wire out of the lines of the Buffalo, Kenmore & Tonawanda trolley system. Most of us have seen the late Old Hoss Hoey get away with a red-hot stove, but the man who steals live trolley wire must have a nerve several degrees higher than that of the tramp so truly characterized by Hoey.

We congratulate the city of Brooklyn, N. Y., on the possession of a handsome electric fountain located in the Prospect Park Plaza. At the first public exhibition of the beauties of this work of adornment 100,000 citizens were present.

Mr. Thomas B. Dixon is announced as the latest telegraphic inventor. He comes to the front with a method of sextuplex telegraphy, but, as his invention has as yet been described only in the daily press, the proper data on which to base a criticism are not available.

Tesla is quietly pursuing his fruitful labors, and, devoted as he is to the cause of science, remains undisturbed by journalistic sensationalism and consequent criticism of the uninformed. In this issue he again makes a particularly valuable and practical contribution to the important field which Lenard and Roentgen have opened up.

Col. W. L. Strong, former president of the Brush-Swan Electric Company, of New England, will very probably be the first Mayor of the Greater New York. Colonel Strong is the present Mayor of New York city, and his acceptable and successful administration now promises to again make him a candidate, even though he is personally unwilling. We believe he is the man.

PROSPERITY.

There is no doubt about the fact that the wave of prosperity has begun to roll. It behooves every business man to get his affairs in shape to handle a larger fall trade than he has been called upon to meet for four years past.

Our crops are more than usually abundant, and the prices for grain are away up. This means that the farmers will have plenty of money in the fall, and consequently trade will be stimulated. The railroads are doing a great business handling the crops already harvested; in some places there is a car famine.

The tariff bill has been passed and promises to give the government sufficient revenue. Business men in every line have already adapted themselves to its new conditions, and can now proceed with their affairs in confidence.

Labor is in demand. The only croakers left are the loafers and professional Weary Willies.

An electric light superintendent in Topeka, Kas., had more work last week than he could get men to perform. All the large electrical manufacturing companies and most of the smaller ones have their shops full of work and orders to fill. Electrical contractors are looking forward to a tremendous business as soon as the hot weather is over. They base their opinion on inquiries received during the past month. President Edward E. Poor of the National Park Bank of New York city, has received nearly 100 letters from bankers in nearly every State in the Union, written in reply to questions concerning business conditions. They all agree that a great wave of prosperity and good times is sweeping over the country. There is a larger volume of business, more men are at work, and confidence is growing. Prosperity is upon us, and the man who doesn't get his share of it has no one to blame but himself.

The few readers of our esteemed contemporary, the *Electrical Engineer*, will, no doubt, be somewhat surprised to learn from its issue of July 29 that Mr. D. McFarlan Moore is only promising now to bring forth improvements "that will place vacuum-tube lighting abreast of incandescent lighting in economy." As far back as October 23, 1895, they were informed editorially that "even in its present condition the system already possesses unquestioned commercial value." And in the issue of April 29, 1896, quoting only one of the many bald assertions, it was editorially stated that, "as to its economy, that point seems to be well disposed of." The ever and ever few readers of our contemporary will be struck by such evidence of conscientiousness and appreciation of journalistic responsibility to the public of these able editors. They will also be profoundly grateful for the most valuable information given about the Moore vibrators, which have been mastered and perfected to be abandoned! The great surprise, however, is the conclusion which they announce that Mr. Moore has reached; namely, that "the solution of the vacuum-tube lighting problem lay in breaking an inductive circuit in vacuum." We are ourselves gratified to finally learn what our ill-advised contemporary supposes to be an invention. Inductive circuits have been broken in vacuum for 40 years or more, ever since the invention of Poggendorf, and vacuum tubes have been used during all that period, and if, without the aid of a novel principle, such solution of the lighting question is reached, it will be the more welcome, as everybody will be free to use it.

TESLA ON THE SOURCE OF ROENTGEN RAYS AND THE PRACTICAL CONSTRUCTION AND SAFE OPERATION OF LENARD TUBES.

To the Editor of Electrical Review:

I have for some time felt that a few indications in regard to the practical construction of Lenard tubes of improved designs, a great number of which I have recently exhibited before the New York Academy of Sciences (April 6, 1897), would be useful and timely, particularly as by their proper construction and use much of the danger attending the experimentation with the rays may be avoided. The simple precautions which I have suggested in my previous communications to your esteemed journal are seemingly disregarded, and cases of injury to patients are being almost daily reported, and in view of this only, were it for no other reason, the following lines, referring to this subject, would have been written before had not again pressing and unavoidable duties prevented me from doing so. A short and, I may say, most unwelcome interruption of the work which has been claiming my attention makes this now possible. However, as these opportunities are scarce, I will utilize the present to dwell in a few words on some other matters in connection with this subject, and particularly on a result of importance which I have reached some time ago by the aid of such a Lenard tube, and which, if I am correctly informed, I can only in part consider as my own, since it seems that practically it has been expressed in other words by Professor Roentgen in a recent communication to the Academy of Sciences of Berlin. The result alluded to has reference to the much disputed question of the source of the Roentgen rays. As will be remembered, in the first announcement of his discovery, Roentgen was of the opinion that the rays which affected the sensitive layer emanated from the fluorescent spot on the glass wall of the bulb; other scientific men next made the cathode responsible; still others the anode, while some thought that the rays were emitted solely from fluorescent powders or surfaces, and speculations, mostly unfounded, increased to such an extent that, despairingly, one would exclaim with the poet:

"O gluecklich wer noch hoffen kann,
Aus diesem Meer des Irrtums aufzutauchen!"

My own experiments led me to recognize that, regardless of the location, the chief source of these rays was the place of the *first* impact of the projected stream of particles within the bulb. This was merely a broad statement, of which that of Professor Roentgen was a special case, as in his first experiments the fluorescent spot on the glass wall was, incidentally, the place of the first impact of the cathodic stream. Investigations carried on up to the present day have only confirmed the correctness of the above opinion, and the place of the first collision of the stream of particles—be it an anode or independent impact body, the glass wall or an aluminum window—is still found to be the principal source of the rays. But, as will be seen presently, it is not the only source.

Since recording the above fact my efforts were directed to finding answers to the following questions: First, is it necessary that the impact body should be within the tube? Second, is it required that the obstacle in the path of the cathodic stream should be a solid or liquid? And, third, to what extent is the velocity of the stream necessary for the generation of and influence upon the character of the rays emitted?

In order to ascertain whether a body located outside of the tube and in the

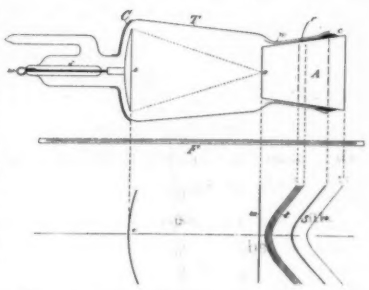

Fig. 1.—Illustrating an Experiment Revealing the Real Source of the Roentgen Rays.

path or in the direction of the stream of particles was capable of producing the same peculiar phenomena as an object located inside, it appeared necessary to first show that there is an actual penetration of the particles through the wall, or otherwise that the actions of the supposed streams, of whatever nature they might be, were sufficiently pronounced in the outer region close to the wall of the bulb as to produce some of the effects which are peculiar to a cathodic stream. It was not difficult to obtain with a properly prepared Lenard tube, having an exceedingly thin window, many and at first surprising evidences of this character. Some of these have already been pointed out, and it is thought sufficient to cite here one more which I have since observed. In the hollow aluminum cap A of a tube as shown in diagram Fig. 1, which will be described in detail, I placed a half-dollar silver piece, supporting it at a small distance from and parallel to the window or bottom of the cap by strips of mica in such a manner that it was not

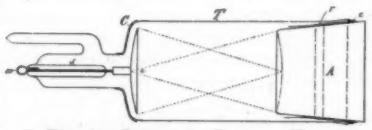

Fig. 2.—Improved Lenard Tube.

touching the metal of the tube, an air space being left all around it. Upon exciting the bulb for about 30 to 45 seconds by the secondary discharge of a powerful coil of a novel type now well known, it was found that the silver piece was rendered so hot as to actually scorch the hand; yet the aluminum window, which offered a very insignificant obstacle to the cathodic stream, was only moderately warmed. Thus it was shown that the silver alloy, owing to its density and thickness, took up most of the energy of the impact, being acted upon by the particles almost identically as if it had been inside of the bulb, and, what is more, indications were obtained, by observing the shadows, that it behaved like a second source of the rays, inasmuch as the outlines of the shadows, instead of being sharp and clear as when the half-dollar piece was removed, were dimmed. It was immaterial for the chief object of the inquiry to decide by more exact methods whether the cathodic particles actually penetrated the window, or whether a new and separate stream was projected from the outer side of the window. In my mind there exists not the least doubt that the former was the case, as in this respect I have been able to obtain numerous additional proofs, upon which I may dwell in the near future.

I next endeavored to ascertain whether it was necessary that the obstacle outside was, as in this case, a solid body, or a liquid, or broadly, a body of measurable dimensions, and it was in investigating in this direction that I came upon the important result to which I referred in the introductory statements of this communication. I namely observed rather accidentally, although I was following up a systematic inquiry, what is illustrated in diagram Fig. 1. The diagram shows a Lenard tube of

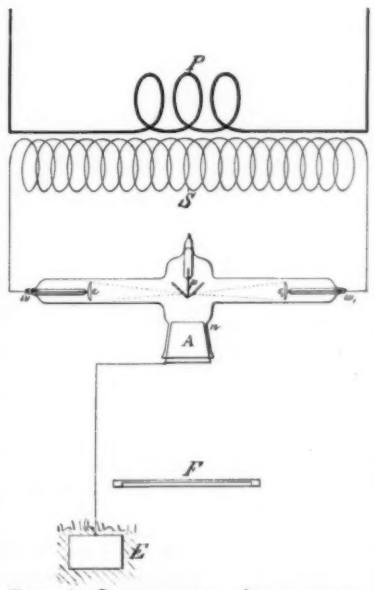

Fig. 3.—Illustrating Arrangement with Improved Double-Focus Tube for Reducing the Injurious Actions.

improved design, consisting of a tube T of thick glass tapering towards the open end, or neck *n*, into which is fitted an aluminum cap A, and a spherical cathode *e*, supported on a glass stem *s*, and platinum wire *w* sealed in the opposite end of the tube as usual. The aluminum cap A, as will be observed, is not in actual contact with the ground-glass wall, being held at a small distance from the latter by a narrow and continuous ring of tinfoil *r*. The outer space between the glass and the cap A is filled with cement *c*, in a manner which I shall later describe. F is a Roentgen screen such as is ordinarily used in making the observations.

Now, in looking upon the screen in the direction from F to T, the dark lines indicated on the lower part of the diagram were seen on the illuminated background. The curved line *e* and the straight line W were, of course, at once recognized as the outlines of the cathode *e* and the bottom of the cap A respectively, although, in consequence of a confusing optical illusion, they appeared much closer together than they actually were. For instance, if the distance between *e* and *o* was five inches, these lines would appear on the screen about two inches apart, as nearly as I could judge by the eye. This illusion may be easily explained and is quite unimportant, except that it might be of some moment to physicians to keep this fact in mind when making examinations with the screen as, owing to the above effect, which is sometimes exaggerated to a degree hard to believe, a completely erroneous idea of the distance of the various parts of the object under examination might be gained, to the detriment of the surgical operation. But while the lines *e* and W were easily accounted for, the curved lines *t*, *g*, *a* were at first puzzling. Soon, however, it was ascertained that the faint line *a* was the shadow of the edge of the aluminum cap, the much darker line *g* that of the rim of the glass tube T, and *t* the shadow of the tinfoil ring *r*. These shadows on the screen F clearly showed that the agency which affected the fluorescent material was proceeding from the space outside of the bulb towards the aluminum cap, and chiefly from the region through which the primary disturbances or streams emitted from the tube through the window were passing, which observation could not be explained in a more plausible manner than by assuming that the air and dust particles outside, in the path of the projected streams, afforded an obstacle to their passage and gave rise to impacts and collisions spreading through the air in all directions, thus producing continuously new sources of the rays. It is this fact which, in his recent communication before mentioned, Roentgen has brought out. So, at least, I have interpreted his reported statement that the rays emanate from the irradiated air. It now remains to be shown whether the air, from which carefully all foreign particles are removed, is capable of behaving as an impact body and source of the rays, in order to decide whether the generation of the latter is dependent on the presence in

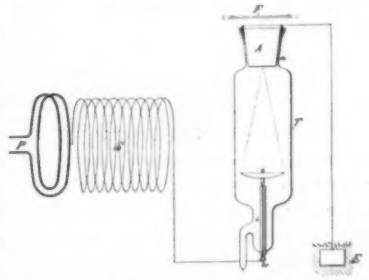

Fig. 4.—Illustrating Arrangement with a Lenard Tube for Safe Working at Close Range.

the air of impact particles of measurable dimensions. I have reasons to think so.

With the knowledge of this fact we are now able to form a more general

(Concluded on page 71.)

A NEW FORM OF INDUCTION COIL.

READ AT THE FOURTEENTH GENERAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, ELIOT, ME., JULY 26–28, 1897, BY PROF. ELIHU THOMSON.

The induction coil presently to be described, it is believed, constitutes a new type employing the principle of a "substitute primary" or "secondary primary," which principle has been applied by me in a variety of ways.

The prime object of this coil is to permit the direct connection to circuits of considerable potential for obtaining energy for the production of high-potential discharges, like those of a Ruhmkorff coil for working Roentgen-ray vacuum tubes, and for such like purposes. The object, also, was to avoid the employment of banks of lamps or storage batteries, and to limit the energy consumed to only that amount required to work the coil itself. Furthermore, no larger condensers than those ordinarily used with an induction coil of equal capacity are needed, and no air-blast, while the coil as a whole is still available as an ordinary Ruhmkorff without change in its structure or connections.

To illustrate the principle, reference is made to Fig. 1, where *p n* represent connections to mains at, say, 110 volts difference of potential; I I is an iron wire core around which are wound two coils, one over the other, either of which may, of course, be the primary. The inner coil P in the figure is made the primary, and is wound with many turns of comparatively fine wire. For 110 volts it may have some thousands of turns and be wound with a wire safe for .5 to .75 ampere. The outside wire S may be coarse or fine. In the figure it is quite coarse and of relatively few turns, since it is assumed to give low potential and large current. The coil S is so proportioned as to be practically almost short-circuited at intervals by its load at B, which is three cells of storage battery in series, for example. The object is assumed to be that the batteries are charged by transference of energy from coil P to S at low potential in S. The coil S should have ample copper so as to lower its internal resistance as much as possible; the resistance of the cells B should be low; and the average voltage of discharge of S much superior to the counter electro-motive force of B. Two synchronously revolving break-pieces, E, F, which may, in fact, be combined into one, are used; E is for governing the intervals of passage of current in coil P and connection of condenser C across the break or interruption periodically made between one terminal of P by a brush G and a metallic segment on E occupying a considerable arc on its periphery. Brush H connects to main *n*. Back of the main segment on E is a small condenser segment in continuous connection with one side or foil of the condenser, and the other side is connected to the other terminal of P, or that leading direct from line *p*. The contact maker and breaker F has a segment which is in continuous connection with one terminal of battery B to be charged, and which touches a stationary brush J, at or about the time of the break between brush G on the main segment of E. The battery B may have terminals by which it may furnish current while being charged.

Now let the break-wheels E and F be given rapid revolution, say, 10, 20 or 30 per second. The contact of brushes G and H with the main segment of E passes current for a certain considerable fraction of the revolution, at full line potential of 110 volts, through primary P. The current rises gradually during this period, and may at the end attain a value of one ampere, more or less. With slow revolution it would be limited by the resistance of P chiefly, but at rapid rates, the time constant of P acting as a self-induction, determines the ultimate value of current before breaking. Upon the break of brush G with the main segment it touches the condenser segment, which is thereby put across the break; but the circuit of S is also closed by contact of segment on F with brush J. The condenser receives only a small charge on account of the circuit of S having been closed. In fact, the break at G with main segment of E would be nearly sparkless without the condenser C, but what slight self-induction is not wiped out by the mutual induction of the currents in S and P is very easily taken care of.

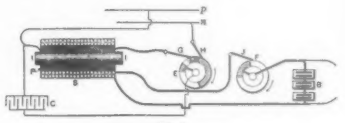

FIG. 1.

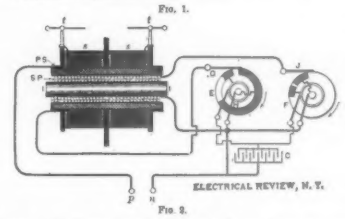

FIG. 2.

PROF. ELIHU THOMSON'S NEW FORM OF INDUCTION COIL.

The magnetizing of the core I I or absorption of energy is by P, while delivery of energy is by S, acting as if nearly on a closed circuit. This condition, however, does not involve much waste of energy if the ohmic resistance of the circuit of S be low enough. Here, then, is a transfer of energy from one circuit to another while the currents are direct currents in each circuit. To insure this being the case in S, the time of contact of segment on F with brush J must be selected so as not to permit any reversal; i. e., the break of said segment with K must be timed to be made on the cessation of the first impulse or discharge from S. To do this an ammeter, responding to direct currents only, placed in the battery circuit or in the leads from S, will indicate a maximum direct current when the segment F is of proper extent, and less under other conditions.

With the principles of the above apparatus in mind it is easy to understand the action of my new form of induction coil, which may be described, briefly, as follows: The iron core I, Fig. 2, of the induction coil is wound with the ordinary coarse primary coil and terminals provided therefor. Then a coil of intermediate gauge, between the inner primary and the outer secondary, is wound. It is to be capable of being connected across a circuit of 110 volts as with coil P, Fig. 1. This coil is the true primary or energy supplying coil, but for convenience and saving of wire I prefer to connect it in as the under portion of the real secondary circuit. It thus becomes useful as a part of the secondary itself, and having several thousand turns adds a considerable fraction to the total potential of the secondary. The secondary is, as usual, of quite fine wire of many thousands of turns, well insulated throughout.

In Fig. 2 the coarse coil is marked S P, and the intermediate coil P S, while that outside is marked S. The functions of the coils S P and P S are to act as secondaries and primaries alternately. This is, in fact, an essential function of S P, but is only incidental to coil P S, having been connected into the secondary circuit S, whose terminals are at *t t*. The break-wheels E F are like those of Fig. 1, except that in F there is a much shorter main segment and a condenser segment following, as in E. There is no battery in the circuit of S P, but it is put on dead short-circuit at intervals, just at the time P S is broken. Coil P S receives current from line at *p n*, at 100 to 200 volts, or more. On the break of this circuit at brush G the ampere turns, so to speak, are shifted suddenly into circuit of S P, closed on itself by J F. The consequence is that even at slow breaks no spark occurs at the rupture of G E. As soon as the current has been fully established in S P on short circuit, and after brush Q has got entirely away from all metallic connections on E, the main segment of F breaks the circuit of S P, which is conveying a very heavy current at low potential. The condenser C is put instantly across the break, and the spark flies between terminals *t t*. In this way a coil of the size of a six-inch Ruhmkorff gives a torrent of six-inch sparks, with an average current from a 110-volt line of about one-half an ampere. A simple motor or clock-work may be used to drive the break-wheels E F, which are made of fair diameter to insure accuracy in operation. The best results are only to be obtained when the proportioning of the parts is carefully done, and with a knowledge of the result to be obtained.

The discharges are indistinguishable from those of a similar Ruhmkorff. In fact, the coil described might be used with the same condenser C as an ordinary Ruhmkorff coil energized by batteries. In this case the terminals of the coil section P S are disconnected, brush J lifted and battery inserted between brush G and terminal of S P, which goes to J in Fig. 2. The break-wheel E or F, when run with low potentials, may be immersed in water in the usual way to facilitate sharp breaks, but the apparatus has been very successfully run, at full output, dry, or a little heavy oil on the break suffices. Also, the flux of current in S P may be made by a magnet to break its own circuit under water when the current has risen to a predetermined amount. In other words, it may be provided with the usual automatic break, damped or adjusted not to get into tremulous vibration. It will be seen from the above description that a new way of energizing an induction coil or other transforming apparatus has been embodied, and that it consists in the rapid substitution of secondary and primary functions in the coil S P.

John H. and Harry L. Lamson have commenced a suit against the Akron, Bedford & Cleveland, Ohio, Electric Railroad Company, to compel appropriation of alleged property rights. The plaintiffs say that they own 2,000 feet of land on the line of the railway, and they want money for their rights in the street, which they claim have been usurped by the railway company.

ELECTRIC RAILWAY NOTES.

McKinzie, Flint & Winsby have levied an attachment on all the stock of the Citizens' Traction Company, of San Diego, Cal., owned by G. B. Kerper and C. W. Foote, to secure payment of an alleged debt of $607.20.

A trust mortgage for $552,000 from the Falls Road Electric Railway Company, of Baltimore, to the Maryland Trust Company, to secure the issue of an equal amount of bonds, has been recorded. The bonds will run for 50 years and will bear five per cent interest.

The Milwaukee, Wis., Electric Railway and Light Company has completed negotiations for the purchase of the property of the Waukesha Beach Electric Railway Company, consisting principally of the tracks, right of way, etc., from Waukesha to Pewaukee Lake.

The Waukesha, Wis., Electric Railway Company, Stutley I. Henderson, stockholder, has petitioned for the appointment of a receiver to wind up the affairs of the company, which was capitalized at $3,000,000. The company was incorporated a year ago, but only enough of the road was built to protect the franchise.

The Board of Public Works is considering a proposition of the Milwaukee, Wis., Electric Railway and Light Company for burying its feed wires along Grand avenue, except along the block between Tenth and Eleventh streets, where they are to remain overhead, because of the board's refusal to tear up the asphalt pavement.

The Postal Telegraph Company, of Portland, Me., has brought suit in the United States Circuit Court against the Portland & Yarmouth Railroad Company. The case arises out of the setting of the trolley poles of the Yarmouth road, the Postal Telegraph Company claiming that the trolley wires have been placed so near to the telegraph wires as to make the latter nearly useless for the transmission of messages.

Mrs. Luther Lane has brought an odd suit against the Cleveland, Ohio, Electric Railway Company. She claims damages for two separate causes of action, but both of them involve the same state of facts, except that they occurred several years apart. The first cause arose April 18, 1894. Plaintiff charges that she was on one of the defendant's cars and wished to alight at the corner of Dunham and Lexington avenues. She says that the car was started before she could get off, and that she was thrown to the ground, injuring her arm, shoulder and hip, and suffering great nervous shock from her fall. For this she claims $2,500. May 24, 1897, at the same corner, in one of defendant's cars, she charges that she was again thrown down in the same way, and injured the same shoulder, arm and hip. Damages in this case are laid at $3,000. She charges that her injuries were so severe that she has not been able to attend to her duties as a housewife since.

Professor Farmer's Experiment in Making Hardened Copper.

In a recent issue of the Boston *Herald* appears the following interesting communication from Mr. Spencer Borden, of Fall River, Mass.:

At a time when electricians are doing honor to the memory of the late Professor Farmer, celebrating the 50th anniversary of his application of electricity to vehicles as a mode of locomotion, I deem it proper to mention one of Professor Farmer's experiments that I have never seen reported, and which he told me, as one working in the same lines he had been investigating.

I think it was in 1872 that I conducted the experiments referred to. I was trying the result of casting ordinary gray cast-iron, within the influence of a strong electro-magnetic field. It was before the days of the Gramme machine or any other direct-acting dynamo, so my experiments were made with the large Bunsen battery of Brown University, kindly loaned me for the purpose.

Having wound a large magnet in cylindrical form, I had moulder's sand packed within the cylinder about the patterns of castings I wished made, then withdrew the patterns and left an ordinary mould within my cylindrical coil of wire. I then attached my battery, and completed the connections, so that the full current of the battery flowed through the coil, thus creating a strong magnetic field, which was maintained all the time that the iron was being poured and until it had become cool.

The effect was very remarkable, producing a polarization of the iron in the direction of the axis of the magnet, making the casting more fibrous than crystalline, and permitting of hammering to a chisel edge when afterward heated to a cherry red, nearly as well as though the iron had been annealed, like ordinary malleable iron.

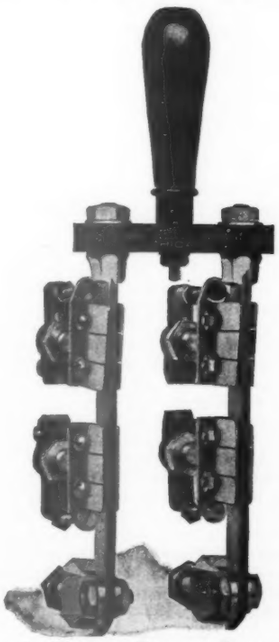

FIG. 2.—WESTERN ELECTRIC COMPANY'S TWO-POLE "EE" SWITCH.

Meeting Professor Farmer shortly afterward, I told him of my experiment. He seemed greatly interested. He said that it reminded him of one of his own. He also had made a large cylindrical magnet, within which to make certain experiments, as I had. He told me that within this magnet field he had placed a vessel filled with a liquid copper salt, within which he had deposited a thick coat of copper electrolitically on an object hung in the liquid, and that electrolitic deposit had been made within the magnetic field, just as my casting had been. He said that when the experiment was completed, and he withdrew the object upon which the copper had been deposited from the bath, he was astonished to find the copper as hard as the hardest steel.

Professor Farmer then suggested that possibly this might be a rediscovery of one of the lost arts, it being known that the ancient Egyptians had only copper implements for manipulating the porphyry of which their monuments were made, and the wonder of modern times being how they were able to produce the hardness in the copper to deal with such hard rocks. He encouraged me to pursue my experiments further, and told me to start where he left off with his. Since that time the pressure of my regular business has prevented me from doing any purely scientific investigation.

I therefore make public these experiments, that some one else may take them up, if sufficiently interested; also that Professor Farmer may have the credit due his memory for his important contribution to the advancement of knowledge.

A Case of Misplaced Confidence.

It is not often that one hears of a case of downright breach of confidence among electric light or street railway people, for, as a rule, there is not a manufacturer or dealer or contractor whose word is not as good as his bond. The following instance of misplaced confidence, however, shows such a gross lack of honesty on the part of the offender that it is given for the benefit of those who may meet with similar experiences. It seems that a prominent traction company, not very far from Chicago, was in the market for a number of cars. A well known manufacturer of drawbars wrote the company, setting forth the claims and merits of his device, and in reply was invited to be present at the company's offices on a certain day when the bids were to be opened, and when he would be given an opportunity to explain personally the good points of the drawbar, so that the company might specify that kind in placing the orders for cars. Promptly on the day and hour the manufacturer of drawbars appeared at the company's offices, where he met several car manufacturers, all anxious to secure the rather large order for cars. While waiting for an opportunity to present himself to the general manager of the traction company, he became engaged in conversation with the president of a prominent car manufacturing concern, who learning the object of his visit said:

"Look here, Mr. Drawbar-man, I am sure of getting this order, if I can get to talk to these people at once, and if you will go home and not take up these people's time, I'll go in and get the order, and mail you an order for the drawbars to-morrow."

"All right," said the drawbar maker, glad to make sure of the order so easily; "I'll take your word for it, and shall expect the order for drawbars in a day or two."

The street car man promptly got the car contract, but, so far, the drawbar man is still waiting for the order for drawbar equipments, which, of course, will never come, a cheaper and less efficient pattern having been furnished. And the drawbar manufacturer is wondering whether or not all men are liars.

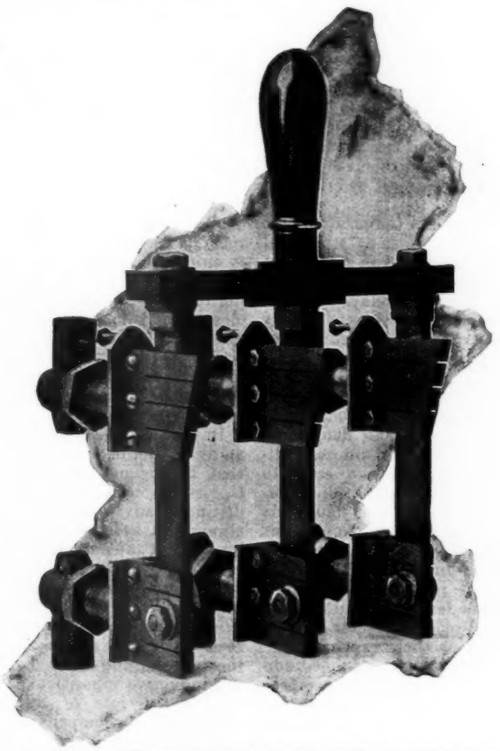

FIG. 1.—WESTERN ELECTRIC COMPANY'S THREE-POLE "E" SWITCH.

The city of Louisville, Ky., has withdrawn its suit against the Louisville Railway for $166,000 franchise tax. No explanation was given except that a suit against the gas company will be used as a test suit. A compromise is probable.

Western Electric Company's Switches.

The Western Electric Company, of New York and Chicago, has recently placed on the market a complete line of high-grade switches, several types of which are shown in the accompanying illustrations. The switch shown in Fig. 1 is known as the three-pole of the "E" type. The blade is of hard-drawn copper of very high conductivity, but is allowed a carrying capacity of only 900 amperes per square inch. The brushes are of hard-rolled copper, and the posts carrying the current through the board are cast of a special composition, the conductivity of which is almost the same as that of copper. Connections are to be made on the back of the board by means of revolving lugs clamping round the lower part of the posts, allowing circuit wires to be connected from any direction. The cross-piece is of hard rubber; the handle is of hard wood, enameled finish, with a bolt through its entire length. All parts are easily removed and can be duplicated by order. This type of switch is made in sizes from 25–50 amperes to 1,200–2,000 amperes.

The type "EE" switch, shown in Fig. 2, possesses the same features as the "E" switch, the parts being almost the same. They are, however, special switches made to order. They have two brushes to each blade, and the hinge post is not used for connections.

The switch illustrated in Fig. 3 is known as the "Q" type, is a quick-break device, and is designed to be used where large currents are to be opened. The opening being almost instantaneous, the arc is reduced to a minimum, thereby saving the blade and brushes from burning. These switches have claimed for them the great advantage of breaking at all four brushes in the same time.

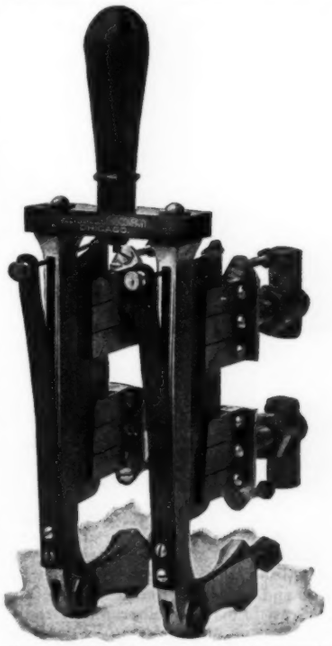

FIG. 3.—WESTERN ELECTRIC COMPANY'S TWO-POLE "Q" SWITCH.

In a new catalogue just issued by the Western Electric Company these and other switches are fully described. This catalogue, which is sent free on application, contains a great deal of valuable data on switches and switchboards.

THE RELAY AND ITS RELATION TO THE TELEGRAPHIC CIRCUIT.

READ BEFORE THE ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS, NIAGARA FALLS, JUNE 16, 1897, BY THOMAS D. LOCKWOOD.

(*Continued from page 56.*)

We thus learn, not only that to get magnetic strength we must have a good allowance of ampere turns, but also that in a line of many relays the resistance of all of them, to get the best results all round, should be the same. If one is 150 ohms, all should be 150 ohms. If a lesser resistance be adopted, still all should have the same. The reason for this is plain.

If 20 relays on a line are each 150 ohms, and a new station be opened and provided with a 300-ohm relay, and a winding to correspond, while it is true that the station having the 300 ohms will be likely to always have it work well, all the other stations on the line will suffer, because the total resistance of the circuit has been unduly increased, and the current correspondingly decreased. I learned this experimentally years ago, when buying from the late L. G. Tillotson a relay for a new telegraph office on a railway wire having already upwards of 25 relays in circuit. He asked me how many offices were so far connected, and on being told, said: "Then you want for your office a 350-ohm relay. That will give you a pull over them all." And it did.

In the discussion last year on Mr. Fry's paper, Mr. Ryder happened to say, "Tradition tells us that the combined resistance on a circuit should equal the resistance on the wire."

That is not quite the tradition or, as it has been called, the "law." Culley, a well known English authority, says of this: "Theoretically, the maximum power of attraction is obtained when the resistance of the coil equals that of the line and battery;" but he hastens to hedge by saying, "But this law is applicable only to a perfectly insulated circuit, and not to the greater number of cases in practical telegraphy."

Our old friend Haskins dug up the so-called law out of Noad's antiquated text book, and quotes it in his little work on the galvanometer as follows: "When the resistance of the coils of the electro-magnet is equal to the resistance of the rest of the circuit, i. e., the conducting wire and battery, the magnetic force is a maximum;" and then he quotes from an early edition of Pope's Modern Practice, to this effect: "The application of this law to a telegraphic circuit would be to make the sum of the resistances of all the magnet coils in circuit equal to the resistance of the line and batteries; but as in practice the resistance of a telegraphic circuit varies, being considerably reduced by defective insulation, the total resistance of the instruments should be less than that of the line when in good condition to attain the best results during unfavorable weather."

Obviously, Mr. Pope's meaning is explained by reference to another saying of Haskins, to the effect that "the difference in resistance between the line wire and the insulators is the margin upon which the line is worked. If that margin is diminished by bad insulation a portion of the current escapes to the ground. If the resistance of the line-wire is increased the margin is again diminished, and a portion of the current escapes as before."

So, while the above law as explained by Mr. Pope is clearly a good one and ought to be followed, it simply means: Don't unduly increase the resistance of your line by adding an extravagant number of stations and a relay at each.

The resistance of your line wire is, generally speaking, fixed. You can't add to that, but you can, if you wish, add more relays. Don't do it; and it doesn't mean add a great many relays to a line; a good many more than it ought to have, and then reduce the resistance of the circuit by crippling the relays.

For a telegraphic superintendent to connect relays without stint in a telegraphic circuit, and to then strive to reduce the resistance of the circuit by winding the said relays with but few turns of wire, and thereby greatly and disproportionately lessening their magnetizing power, is, to my mind, just about as reasonable or as unreasonable as it would be for a man who, having raised an abnormally large family of sons and daughters, and finding the drain of a dozen full-grown stomachs expensive, seeks to economize, not by reducing the number by marrying off his daughters and starting his sons off to look out for themselves, or by engaging the lot in some useful work, which is the common-sense remedy, but by putting the whole family on half rations, and thereby reducing their ampere turns as well as their expense.

The evils consequent on the abnormal number of relays could have been prevented by limiting the number of offices on the circuit, and in the case of the man and his family, by the former remaining in a state of bachelorhood, but having failed to utilize these methods, the scientific remedy in both cases—supposing resistance in one, and expense in the other to be the only evils—is to remove the surplus relays from the circuit, and the surplus number of idle members from the family.

And as I view the question—still assuming that great circuit resistance is the only serious evil—if we must by circumstances over which we have no control, retain a multitude of relays in the same circuit, there is great advantage in keeping the ampere turns or magnetizing power as high as possible, for the same reasons which would induce us to construct lightning circuits in such a way that the receptive devices shall collectively have a much higher resistance than that of the line portion of the circuit; viz., to concentrate the major part of the fall of potential in the instruments; or in other words to condense the energy expended, or the work done, or the watts, in the receiving devices, and not in the line wire.

The parallel connection mode of cutting down relay resistance must now be specially considered, since it is evident that it accomplishes something more than superficially appears. It is not a new idea by any means. First suggested by Henry in his early experiments, it was patented August 16, 1870 (No. 106,418), by our own old friend, William Wiley Smith, who, however, apparently saw nothing more in it than the decrease of circuit resistance. It has been employed in the British post office telegraph relays for a long time, and has been publicly advocated by myself as a good way of connecting telephone polarized bell spools at way stations.

But if it effected nothing more than the decrease of resistance, I doubt whether the change would be worth while, in view of the fact that by making it we cut the ampere turns in half. But there is something more to which we can not, and must not, shut our eyes. Every relay has to be considered, not only as a signal receiver, but likewise as an electro-magnetic resistance, through which all of the current pulsations of the circuit must pass. Each relay is, indeed, a small dynamo, with one winding serving both as a field and armature winding, and every time its core is magnetized or demagnetized by the opening or closing of a key, the coil surrounding such core has a current generated in it by self-induction (each turn inducing a current in each neighboring turn), which current is in opposition to the line current when the circuit is closed and in coincidence with it when the circuit is broken; and as this occurs at every relay on the line, the combined effect is quite pronounced, and operates to make the line current slow in reaching its full strength when the circuit closes and slow in losing its full strength when the circuit breaks.

The irons of the cores also possess magnetic inertia which tends to make them slow in acquiring and parting with magnetism.

In the case of a telegraph line with many relays, it is easily conceivable that the combined effect of these factors becomes so serious that it is distinctly advantageous if it can be eliminated, even at the expense of a loss of half the ampere turns of every relay, or, in other words, that the advantage gained by connecting the relay coils in multiple—taking everything together; to wit, the decreased resistance, the decreased magnetic inertia, and the marked decrease in self-inductive opposition—by far outweighs the loss of ampere turns necessarily accompanying such a change, and this circumstance is in all probability the real key to the resultant improvement noted by Messrs. Fry and Ryder.

It is customary for experts to explain the improvement resulting from such a change by saying that it tends to reduce the "time constant" of the instruments. This explanation is true enough, but the trouble with it is that it doesn't explain anything. When we say that the time constant of a relay magnet is reduced, we mean that it allows its magnetizing current to rise to a certain definite fractional part of its maximum and final value, in a shorter period than was the case prior to such reduction, that the receiver is thus rendered much more susceptible to the very first impulses of the received current than it would be with a series arrangement of its coils, and gets rid of the effects of its final impulses also quicker.

For, in the first place, the parallel connection of all the relay spools of the circuit reduces the electro-motive force of the retarding and prolonging self-induction current in each spool, and thus diminishes the opposing effect 50 per cent; this reduction in a large number of relays, and, of course, in the main circuit, amounts to a very important quantity; in the second place, the magnetic inertia of the core is reduced and its capability of magnetic change quickened by allowing each spool winding to act upon a portion only of the core; and in the third place, the parallel connection of the two spools of each relay probably enables each to serve as a shunt for the other, so that a short local circuit is formed of the two spools in which, since the resistance of such short circuit is so much less than that of the line, the self-induction currents, in part at least, neutralize each other.

The second of these advantages would be still further amplified by suppressing the iron bar, which ordinarily connects the two branches of the core.

(*To be concluded.*)

PERSONAL.

Mr. Billings P. Learned, of New London, Ct., a retired New York banker, was recently elected president of the Norwich, Ct., Street Railway Company.

Mr. E. W. Little, well known in electrical circles, is interested as a director in the Foward Reduction Company, of New York city. Working under the patents of Dr. Foward, this company will refine crude oil and manufacture high-grade asphalt from the residuum.

Mr. Walter C. McKinlock, of Chicago, has opened an office in the Fort Dearborn Building to handle general electrical merchandise. He will represent also eastern houses. Mr. McKinlock has a wide acquaintance with the purchasing electrical field throughout the West.

Dr. Magnus McLean, Professor of Electrical Engineering in the Glasgow University, arrived in New York city last week by the steamship "State of Nebraska." He comes as a delegate to the annual meeting of the British Association for the Advancement of Science, which is to be held in Toronto. Lord Kelvin, it is said, is on his way to attend the meeting.

Mr. Charles H. Wilson, formerly with the Chicago Telephone Company and more recently engaged in electrical construction work in Chicago, has been appointed general manager of the Southern Bell Telephone and Telegraph Company. Mr. Wilson is an experienced telephone manager, and will be an able addition to the staff of president E. J. Hall and secretary D. I. Carson, of the Southern Bell company.

Suits on Battery Carbon Patents.

The Phœnix Carbon Manufacturing Company, of St. Louis, purchased of the Law Battery Company, of New Jersey, in January, 1897, patent No. 500,284, covering a carbon screw connector for all cells of galvanic batteries. It is alleged that at that time this patent was being infringed by the National Carbon Company and others. The Phœnix company brought suit against the National Carbon Company in the United States Court, eastern district of Ohio, and at the same time asked for a restraining injunction. This was granted on June 29 last, and the Phœnix company is now pressing its suit to obtain judgment. The Phœnix company states that it will certainly stop not only the National Carbon Company, but all other parties from infringing, and will be prepared in a very short time to supply the entire trade for this type as well as all other types of galvanic batteries. They have enlarged their factory and are now prepared to fill orders for complete batteries or any of their parts.

An Electric Heater Decision.

On August 2 Judge Wheeler of the United States Circuit Court for the Second Circuit, rendered a decision in favor of the defendant in the case of the Burton Electric Company against the Union Railway, of New York, which was defended by the Consolidated Car-Heating Company. This decision, it is claimed, settles the right of the Consolidated company to use the multiple series system of wiring with their electric heaters.

TESLA ON ROENTGEN RAYS.

(Concluded from page 67.)

idea of the process of generation of the radiations which have been discovered by Lenard and Roentgen. It may be comprised in the statement that the streams of minute material particles projected from an electrode with great velocity in encountering obstacles wherever they may be, within the bulb, in the air or other medium or in the sensitive layers themselves, give rise to rays or radiations possessing many of the properties of those known as light. If this physical process of generation of these rays is undoubtedly demonstrated as true, it will have most important consequences, as it will induce physicists to again critically examine many phenomena which are presently attributed to transverse ether waves, which may lead to a radical modification of existing views and theories in regard to these phenomena, if not as to their essence so, at least, as to the mode of their production.

My effort to arrive at an answer to the third of the above questions led me to the establishment, by actual photographs, of the close relationship which exists between the Lenard and Roentgen rays. The photographs bearing on this point were exhibited at a meeting of the New York Academy of Sciences—before referred to—April 6, 1897, but, unfortunately, owing to the shortness of my address, and concentration of thought on other matters, I omitted what was most important; namely, to describe the manner in which these photographs were obtained, an oversight which I was able to only partially repair the day following. I did, however, on that occasion illustrate and describe experiments, in which was shown the deflectibility of the Roentgen rays by a magnet, which establishes a still closer relationship, if not identity, of the rays named after these two discoverers. But the description of these experiments in detail, as well as of other investigations and results in harmony with and restricted to the subject I brought before that scientific body, will appear in a longer communication which I am slowly preparing.

To bring out clearly the significance of the photographs in question, I would recall that, in some of my previous contributions to scientific societies, I have endeavored to dispel a popular opinion before existing that the phenomena known as those of Crookes were dependent on and indicative of high vacua. With this object in view, I showed that phosphorescence and most of the phenomena in Crookes bulbs were producible at greater pressures of the gases in the bulbs by the use of much higher or more sudden electro-motive impulses. Having this well demonstrated fact before me, I prepared a tube in the manner described by Lenard in his first classical communication on this subject. The tube was exhausted to a moderate degree, either by chance or of necessity, and it was found that, when operated by an ordinary high-tension coil of a low rate of change in the current, no rays of any of the two kinds could be detected, even when the tube was so highly strained as to become very hot in a few moments. Now, I expected that, if the suddenness of the impulses through the bulb were sufficiently increased, rays would be emitted. To test this I employed a coil of a type which I have repeatedly described, in which the primary is operated by the discharges of a condenser. With such an instrument any desired suddenness of the impulses may be secured, there being practically no limit in this respect, as the energy accumulated in the condenser is the most violently explosive agent we know, and any potential or electrical pressure is obtainable. Indeed, I found that in increasing the suddenness of the electro motive impulses through the tube—without, however, increasing, but rather diminishing the total energy conveyed to it—phosphorescence was observed and rays began to appear, first the feebler Lenard rays and later, by pushing the suddenness far enough, Roentgen rays of great intensity, which enabled me to obtain photographs showing the finest texture of the bones. Still, the same tube, when again operated with the ordinary coil of a low rate of change in the primary current, emitted practically no rays, even when, as before stated, much more energy, as judged from the heating, was passed through it. This experience, together with the fact that I have succeeded in producing by the use of immense electrical pressures, obtainable with certain apparatus designed for this express purpose, some impressions in free air, have led me to the conclusion that in lightning discharges Lenard and Roentgen rays must be generated at ordinary atmospheric pressure.

At this juncture I realize, by a perusal of the preceding lines, that my scientific interest has dominated the practical, and that the following remarks must be devoted to the primary object of this communication—that is, to giving some data for the construction to those engaged in the manufacture of the tubes and, perhaps, a few useful hints to practicing physicians who are dependent on such information. The foregoing was, nevertheless, not lost for this object, inasmuch as it has shown how much the result obtained depends on the proper construction of the instruments, for, with ordinary implements, most of the above observations could not have been made.

I have already described the form of tube illustrated in Fig. 1, and in Fig. 2 another still further improved design is shown. In this case the aluminum cap A, instead of having a straight bottom as before, is shaped spherically, the center of the sphere coinciding with that of the electrode *e*, which itself, as in Fig. 1, has its focus in the center of the window of cap A, as indicated by the dotted lines. The aluminum cap A has a tinfoil ring *r*, as that in Fig. 1, or else the metal of the cap is spun out on that place so as to afford a bearing of small surface between the metal and the glass. This is an important practical detail as, by making the bearing surface small, the pressure per unit of area is increased and a more perfect joint made. The ring *r* should be first spun out and then ground to fit the neck of the bulb. If a tinfoil ring is used instead, it may be cut out of one of the ordinary tinfoil caps obtainable in the market, care being taken that the ring is very smooth.

In Fig. 3 I have shown a modified design of tube which, as the two types before described, was comprised in the collection I exhibited. This, as will be observed, is a double-focus tube, with impact plates of iridium alloy and an aluminum cap A opposite the same. The tube is not shown because of any originality in design, but simply to illustrate a practical feature. It will be noted that the aluminum caps in the tubes described are fitted inside of the necks and not outside, as is frequently done. Long experience has demonstrated that it is practically impossible to maintain a high vacuum in a tube with an outside cap. The only way I have been able to do this in a fair measure is by cooling the cap by a jet of air, for instance, and observing the following precautions: The air jet is first turned on slightly and upon this the tube is excited. The current through the latter, and also the air pressure, are then gradually increased and brought to the normal working condition. Upon completing the experiment the air pressure and current through the tube are both gradually reduced and both so manipulated that no great differences in temperature result between the glass and aluminum cap. If these precautions are not observed the vacuum will be immediately impaired in consequence of the uneven expansion of the glass and metal.

With tubes, as these presently described, it is quite unnecessary to observe this precaution if proper care is taken in their preparation. In inserting the cap the latter is cooled down as low as it is deemed advisable without endangering the glass, and it is then gently pushed in the neck of the tube, taking care that it sets straight.

The two most important operations in the manufacture of such a tube are, however, the thinning down of the aluminum window and the sealing in of the cap. The metal of the latter may be one thirty-second or even one-sixteenth of an inch thick, and in such case the central portion may be thinned down by a countersink tool about one-fourth of an inch in diameter as far as it is possible without tearing the sheet. The further thinning down may then be done by hand with a scraping tool; and, finally, the metal should be gently beaten down so as to surely close the pores which might permit a slow leak. Instead of proceeding in this way I have employed a cap with a hole in the center, which I have closed with a sheet of pure aluminum a few thousandths of an inch thick, riveted to the cap by means of a washer of thick metal, but the results were not quite as satisfactory.

In sealing the cap I have adopted the following procedure: The tube is fastened on the pump in the proper position and exhausted until a permanent condition is reached. The degree of exhaustion is a measure of perfection of the joint. The leak is usually considerable, but this is not so serious a defect as might be thought. Heat is now gradually applied to the tube by means of a gas stove until a temperature up to about the boiling point of sealing wax is reached. The space between the cap and the glass is then filled with sealing wax of good quality; and, when the latter begins to boil, the temperature is reduced to allow its settling in the cavity. The heat is then again increased, and this process of heating and cooling is repeated several times until the entire cavity, upon reduction of the temperature, is found to be filled uniformly with the wax, all bubbles having disappeared. A little more wax is then put on the top and the exhaustion carried on for an hour or so, according to the capacity of the pump, by application of moderate heat much below the melting point of the wax.

A tube prepared in this manner will maintain the vacuum very well, and will last indefinitely. If not used for a few months, it may gradually lose the high vacuum, but it can be quickly worked up. However, if after long use it becomes necessary to clean the tube, this is easily done by gently warming it and taking off the cap. The cleaning may be done first with acid, then with highly diluted alkali, next with distilled water, and finally with pure rectified alcohol.

These tubes, when properly prepared, give impressions much sharper and reveal much more detail than those of ordinary make. It is important for the clearness of the impressions that the electrode should be properly shaped, and that the focus should be exactly in the center of the cap or slightly inside. In fitting in the cap, the distance from the electrode should be measured as exactly as possible. It should also be remarked that the thinner the window, the sharper are the impressions, but it is not advisable to make it too thin, as it is apt to melt in a point on turning on the current.

The above advantages are not the only ones which these tubes offer. They are also better adapted for purposes of examination by surgeons, particularly if used in the peculiar manner illustrated in diagrams Fig. 3 and Fig. 4, which are self-explanatory. It will be seen that in each of these the cap is connected to the ground. This decidedly diminishes the injurious action and enables also to take impressions with very short exposures of a few seconds only at close range, inasmuch as, during the operation of the bulb, one can easily touch the cap without any inconvenience, owing to the ground connection. The arrangement shown in Fig. 4 is particularly advantageous with a form of single terminal, which coil I have described on other occasions and which is diagramatically illustrated, P being the primary and S the secondary. In this instance the high-potential terminal is connected to the electrode, while the cap is grounded. The tube may be placed in the position indicated in the drawing, under the operating table and quite close, or even in contact with the body of the patient, if the impression requires only a few seconds as, for instance, in examining parts of the members. I have taken many impressions with such tubes and have observed no injurious action, but I would advise not to expose for longer than two or three minutes at very short distances. In this respect the experimenter should bear in mind what I have stated in previous communications. At all events it is certain that, in proceeding in the manner described, additional safety is obtained and the process of taking impressions much quickened. To cool the cap, a jet of air may be used, as before stated, or else a small quantity of water may be poured in the cap each time when an impression is taken. The water only slightly impairs the action of the tube, while it maintains the window at a safe temperature. I may add that the tubes are improved by providing back of the electrode a metallic coating C, shown in Fig. 3 and Fig. 4.

NIKOLA TESLA.

New York, August 9.

Electric Light Plant Wanted.

Mr. T. J. Lillard, treasurer of the Elkin Manufacturing Company, of Elkin, Surry County, N. C., manufacturers of cotton yarns, twines, etc., writes to the ELECTRICAL REVIEW, under date of August 7, as follows:

"We want prices and estimates on a 400-light incandescent dynamo, switchboard, wire and everything used, to light the town of Elkin with, say 100 16-candle-power street lights, and for 30 stores and residences with eight lights each.

ADVANCE INFORMATION

Electric Light and Power.

WEST BAY CITY, MICH. — The Council decided to build a municipal light plant, at a cost of $20,000.

SHIPPENSBURG, PA.—The citizens of this place will vote on the question of increasing their borough debt $10,000, for the purpose of establishing an electric light plant.

COLUMBUS, IND.—C. M. Keller & Company, of this city, have been awarded the contract for the construction of an electric lighting plant at Edinburg.

CORBIN, OHIO — The Hamilton Electric Company, New York, L. McL. Hamilton, president, will erect an electric light system in Corbin.

MINERVA, OHIO—An electric light plant has been put in.

HANNIBAL, MO.—A special election has been called for August 10, to vote on a proposition to issue bonds to the amount of $8,000, for the purpose of perfecting the city electric light plant, so that electric power may be furnished to private consumers.

JENKINTOWN, PA.—An electric light plant and waterworks will be operated at Hatboro by a syndicate of Jenkintown men, who have purchased a tract of ground for that purpose.

BROOKSVILLE, FLA.—An electric light plant will be established.

LAWRENCEBURG, TENN. — The Town Clerk may be addressed concerning the construction of electric light plant.

RICHWOOD, OHIO—Miller & Horn, of Rushsylvania, have been awarded contract for furnishing the village of Richwood with electric lights.

CINCINNATI, OHIO—Mrs. Elizabeth Zinn, of Clifton, has purchased plant on Eggleston avenue and Sixth street, Cincinnati, and it will be at once remodeled and made into a power plant for manufacturing concerns, which will be furnished with heat, light and power.

CHESTER, S. C.—The General Electric Company, of Atlanta, Ga., has been awarded contract for the erection of $9,000 electric light plant for city.

SUMTER, S. C.—The Sumter Electric Light Company contemplates the enlargement of its plant to supply increased demand.

MAZEPPA, MINN.—An electric light plant is to be run in connection with Rust & Mason's flouring mill at Forest Mills.

BOSTON, MASS.—The Gardner Heat, Light and Fuel Company has petitioned the Gas and Electric Light Commissioners for permission to issue $18,000 worth of bonds.

TOCCOA, GA.—The Toccoa Cotton Mill, W. A. Matheson, president, will put in an electric light plant.

MADISON, FLA.—Wm. S. Jordan, chairman of Electric Light Committee, may be addressed concerning erection of proposed electric light plant.

SCRANTON, MISS.—The Mayor may be addressed concerning water and electric light plants.

DONALDSONVILLE, LA.—Paul Leach, Mayor, can be addressed concerning erection of electric light plant.

BLOSSBURG, PA.—Messrs. Clark & Jones have made application to the Mansfield Borough Council for a franchise for an electric light plant for this place.

VICKSBURG, MICH.—The Marcellus council has granted a franchise to a local concern to put in an electric lighting plant here.

WELDON, N. C.—The Roanoke Navigation and Water Power Company will establish an electric light plant, and the necessary machinery has been ordered.

FAYETTEVILLE, N. C.—An electric light plant will be established, and $15,000 worth of bonds will be issued for same.

SAN ANTONIO, CAL. — The San Antonio Power and Light Company are putting in an electrical engine for pumping the wells on the Seaver place.

HURON, S. D.—Efforts that are being made by Harry Sterling to re-establish an electric light plant here are likely to prove successful.

RIVERSIDE, N. J.—Work has commenced on the new electric light plant at Riverside.

WOODSTOCK, MINN.—The new electric light plant has commenced operations.

HUNTINGDON, TENN.—The Mayor may be addressed concerning erection of electric light plant.

New Electric Railways.

COLORADO SPRINGS, COLO. — An electric road is to be constructed to connect with the Cripple Creek gold camp.

PADUCAH, KY. — The People's Railway Line, including the electric light plant, has been purchased by George C. Wallace for $135,000. Mr. Wallace represents a syndicate of home capitalists.

LONDON, ONT. — The Windsor, Amherstberg & Lake Erie Electric Railway Company has been granted a franchise by the Sandwich Council.

ASHLAND, OHIO—New London & Loudonville Electric Railroad Company has been organized. H. A. Thomas, H. A. Mykrantz, J. R. Swartz, Ashland; G. F. Shelley, Loudonville; S. J. McCready, New London, and Bert Hank and E. J. Best, Cleveland, were elected directors. H. A. Thomas is the president; H. A. Mykrantz, vice-president; F. N. Patterson, secretary, and G. A. Ulman, treasurer.

HAVERHILL, MASS. — The street railroad connecting this place with the sea, via West Newbury, is to be built at once.

MCHENRY, ILL. — The board of supervisors has granted Windsor, Williams & Luck a franchise to build an electric road from this place to Lake Geneva.

PHILADELPHIA, PA. — It is announced that the Philadelphia & West Chester trolley road will be extended to West Chester, and that the historic grounds at Castle Rock will be fitted up as a pleasure resort.

NORWICH, N. Y.—It is reported that there is a project in view for the construction of an electric railroad from Binghamton to Georgetown, Madison County, a distance of about 50 miles.

LISBON, OHIO—A franchise has been granted for an electric railway to run between this place and East Liverpool, a distance of 18 miles.

MIDDLETOWN, N. Y.—The project of consolidating the Middletown-Goshen Traction Company and the Newburgh Electric Railway Company is again being agitated.

IRVIN, PA.—An electric road is to be constructed between this place and McKeesport, Pa., a distance of about 25 miles. Mr. W. F. Sadler, Jr., is manager of this road.

LIMA, OHIO—A company is at work taking up the right of way for an electric railroad to connect this city with Bellefontaine. The proposed line will run through Westminster, Waynesfield, New Hampshire, Lakeview, Lewiston, and thence to Bellefontaine.

MILWAUKEE, WIS.—The Milwaukee Electric Railway and Light Company have about completed plans for commencing operations.

KANKAKEE, ILL.—The Kankakee, Wilmington & Morris Electric Railway Company has been incorporated by Frank B. Handwork, Thomas J. Diven, August D. Ehrich, Cyrus L. Bennett, Philip I. Cromwell, Julius L. Lins and J. A. Henry, to build an electric road to start in Kankakee, run through Wilmington, and thence to Morris. Capital stock, $50,000.

SOUTH BETHLEHEM, PA.—A new trolley road is to be built from South Bethlehem to Hellertown. It will be six miles long, and connect here with Albert L. Johnson's system of electric roads, which traverses the Lehigh Valley for 13 miles.

NEW YORK, N. Y.—The Kings County Elevated Railway Company, of Brooklyn, has decided to adopt electricity as motive power.

BATTLE CREEK, MICH.—A movement is on foot to build an electric railroad from Battle Creek to Kalamazoo, by way of Gull Lake.

BERKLEY, VA.—The Berkley Electric Street Railway Company has completed its trolley line, which is now in operation.

New Telephone and Telegraph Companies.

NEWPORT, ME.—The New England Telephone Company are extending their line from this place to Dexter, via Corinna village. They have a large force of men at work and are making rapid progress.

PALESTINE, TEX.—A long distance telephone is being organized from Hearne to Palestine, and from there to Tyler.

CHAMPAIGN, ILL.—The contract for the erection of the new Bell telephone building on Cortland street has been awarded to Chas. A. Howind. Work is to be commenced at once and the building is to be ready for occupancy October 1.

CHAMPAIGN, ILL.—D. A. Reynolds, of the Jackson Telephone Company, has sold his interest to George A. Beaton, of the Detroit Switchboard and Telephone Construction Company.

FREMONT, OHIO—Messrs. Ed. Barber and Jas. Brailey, Jr., Wauseon capitalists, are forming a company for a new telephone exchange here. Local parties are in the deal.

NORTHVILLE, MICH.—The Northville Telephone Company is rushing its new telephone line from this place to Novi. At that point it will connect with the Warner-Whipple line, thus uniting the towns of Northville, Novi, Farmington and Sand Hill in one circuit.

ASHLAND, KY. — The Lawrence Telephone Company has been incorporated by D. G. Putnam, D. L. Leffingwell and E. C. Means. Capital stock, $12,000.

New Incorporations.

NEW YORK, N. Y.—The Eastern Engineering Company has been incorporated, to carry on a general mechanical and electrical engineering business. Capital, $5,000. Directors: Franklin R. Haines, Sewell T. Tyng, of New York city, and Francis E. Tyng, of Elizabeth, N. J.

PASADENA, CAL.—Smyth Electric Company has been formed by George F. Kernaghan, B. F. Ball, Horace M. Dobbins, R. Eason, David M. Smyth, Joseph E. Smyth and A. R. Metcalf. Capital stock, $300,000.

DETROIT, MICH.—The Fuller & Curtis Company has been incorporated, with Frank E. Kirby, president; Neil McMillan, vice-president; Cameron D. Waterman, secretary; Rodolphus Fuller, general manager, and Wm. H. Curtis, superintendent, to manufacture the Fuller dynamos and other electrical apparatus and the Curtis heaters and ventilating appliances.

Increase of Capital.

BUFFALO, N. Y.—The Buffalo General Electric Company has certified to an increase of capital stock from $1,900,000 to $2,400,000. The liabilities of the company, irrespective of its capital stock and interest due on bonds on August 1, are $10,808.26.

Business Troubles.

PALMYRA, MO. — A receiver has been appointed for the Palmyra Light and Water Company, which was chartered in 1890 with a capital stock of $50,000.

Kindred.... ...Interests

Brush Apparatus continues in demand. The merits of the new large size arc machines are even better appreciated than the old reliable smaller sizes by many central station managers. The Brush Electric Company has reason to be proud of its business reputation and the quality of its products.

Mr. George Bullock emphatically denies the report that the plant of the Bullock Electric Manufacturing Company is to be removed from Cincinnati, Ohio. This company is one of the foremost in the western country, and the territory that it supplies is such that it would be out of the question for it to have its location in any other point than Cincinnati.

The Pacific Electric Company of La Crosse, Wis., has gotten hold of a very clever device called "the electric trick," by which a piece of money can be made to disappear in such a mysterious manner that the most clever person will fail to detect how it is accomplished. The company uses the device to advertise its shade lamps and dental lamps, and will be pleased to send one of these tricks to any one who will write and inclose four cents in stamps to cover the cost of mailing.

The Skowhegan Electric Light and Power Co. has placed a contract for a $10,000 power station, to be built upon the Levi Weston property, at Waterville, Me. It will be of brick, with stone foundations. At present this concern is hiring its motive power from three different parties, the leases of which run out shortly and can not be renewed. This necessitated the purchase of the Levi Weston waterpower, on the Kennebec River, at an expense of $35,000, granting a three years' mill privilege to Weston, who will continue log-sawing.

The Newport News Shipbuilding and Dry Dock Company are making extensive additions to their already large plant at Newport News, Va. One of the large additions under way is the erection of an extension to their machine shop, which will be 100 feet wide and 200 feet long. This building will be used for the finishing and erecting of marine engines and other large machinery used in connection with the mammoth steel vessels which this company have under way. The central portion of the building will be 50 feet high, and will be supplied with an electric traveling crane capable of lifting and carrying a load of 50 tons. On either side of this central space will be located a gallery arranged for small machines and fitting tools. The building is to have a steel framework throughout, and the roof is to be covered with corrugated iron. The Berlin Iron Bridge Company, of East Berlin, Ct., have the contract for furnishing and erecting the steel work of the building.

A Complete Enamel Rheostat Catalogue.

The Ward Leonard Electric Company, of Hoboken, N. J., have just issued their ninth catalogue, in which is illustrated and thoroughly described a complete line of enamel rheostats, of the Carpenter and Ward Leonard types. Just five years ago this company, or rather its immediate predecessors, placed the first enamel rheostats on the market. In this brief time their use has become very general, both in this country and abroad. The present catalogue is filled with valuable information. Mention is made of many hundreds of rheostats for use as field regulators, motor starters, theater dimmers, ventilating fan regulators, etc.

In speaking of the new catalogue, Mr. H. Ward Leonard, president of the company, says: "We think we are one of the very few electrical manufacturing companies whose business has steadily increased during the past few years, and we attribute a great deal of our success to the comprehensiveness of our catalogues, from which electrical people in this and all foreign countries have been able to order any desired rheostat with complete accuracy by a single code word or catalogue number."

Incidentally, it may be mentioned that marked reductions have been made in the price of the Ward Leonard Electric Company's goods. This reduction will average about 25 per cent, and is much more than this in the case of motor rheostats. The company is represented in England by Veritys, Limited, and in Berlin by S. Bergmann & Company. The foreign business of the Ward Leonard Electric Company is at present very large, and is rapidly increasing.

Good Telephone Books.

"PRACTICAL INFORMATION FOR TELEPHONISTS,"
BY THOMAS D. LOCKWOOD.
The Telephone Man's Text Book.
192 Pages. Price, $1.00.

"TELEPHONES, THEIR CONSTRUCTION AND FITTING,"
BY F. C. ALLSOP.
Description of Receivers, Transmitters, Switch Boards, Complete Instrument Switches and Switch Boards, Erecting Telephone Lines, Overhead Wires, Instruments, Connecting, Testing for and removing faults.
256 Pages. Illustrated. Price, $2.00.

"TELEPHONE LINES AND THEIR PROPERTIES,"
BY W. J. HOPKINS.
Contents: Design and Construction of City Lines.
Underground Work.
Long Distance Lines.
Wire, Insulators, Exchanges, Switch Boards.
The Propagation of Energy.
The Telephone Current.
Measurement.
Properties of City Lines, Cables, Etc.
Price, $1.50.

"MANUAL OF TELEPHONY,"
BY W. H. PREECE AND ARTHUR T. STUBBS.
Price, $5.50.

"ELECTRIC TELEPHONY,"
BY E. J. HOUSTON AND A. E. KENNELLY.
New. Price, $1.00.

"HOW TO MAKE AND USE THE TELEPHONE,"
BY GEO. H. CARY.
The purpose for which this book is written is to furnish information to those who may desire to construct or use telephones, telephonic apparatus or lines on a small scale.
Price, $1.00.

"TELEPHONE TROUBLES AND HOW TO FIND THEM."
BY C. R. HASKINS.
A practical little treatise for telephone inspectors, exchange managers, and employés who are not electrical experts, as well as the general public, who use telephones or private lines.
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"THE TELEPHONING OF GREAT CITIES,"
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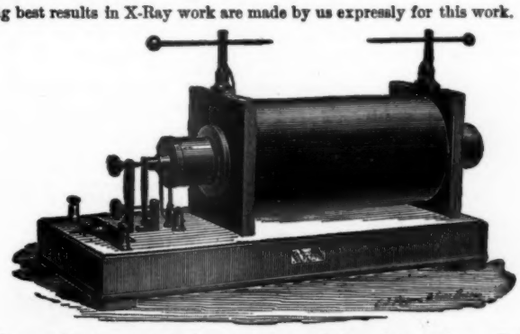

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Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED JULY 27, 1897.

587,081 Telephone exchange apparatus; F. R. McBerty, Downer's Grove, Ill.—A telephone line grounded at two points subject to differences of potential and provided with a generator of alternating current at one sub-station and an annunciator at the other station, a group of polarization cells in one of the ground branches.

587,114 Electric condenser; C. S. Bradley, Avon, N. Y.—An electric condenser having its pile of plates inclosed in a fluid and air-tight metallic casing hermetically sealed at all joints, whereby the access of moisture in the outside air is prevented and the capacity is kept unaltered.

587,119 Telephony; J. W. Gibboney, Lynn, Mass.

587,120 Telephony; J. W. Gibboney, Lynn, Mass. — A bell-operating magnet having upon its core a primary coil in the main line circuit, and a transmitter and receiver in a local circuit of coarser wire forming a secondary to said primary coil.

587,143 Electric programme clock; E. Bobsien, Mount Vernon, N. Y.

587,163 Multipolar dynamo electric machine; S. W. Rushmore, Brooklyn, N. Y.—An armature, several magnets arranged about the armature and sets of brushes for separately collecting the currents generated in the parts of the armature under the different magnets, independently of other sections, and connections from each set of brushes through the field coil of its magnet only.

587,164 Dynamo-electric machine; S. W. Rushmore, Brooklyn, N. Y.

587,182 Electric furnace; G. de Chalmot, Leaksville, N. C.—Consists of the carbon pencil and a crucible or hollow hearth, wheels on which said crucible is mounted, a track on which said wheels roll, and a mechanism for reciprocating said crucible by rolling it back and forth on said track.

587,204 Switchboard annunciator; N. H. Holland, Montreal, Canada.

587,217 Fuse-holder and electric cut-outs; H. A. Lewis, Norristown, Pa.

587,226 Telephone trunk-circuit; J. J. O'Connell, Chicago, Ill.

ISSUED AUGUST 3, 1897.

587,296 Electric bale-tie machine; W. O. Bates, Joliet, Ill.

587,311 Regulating admission of currents to motors; F. E. Herdman, Winnetka, Ill.

587,336 Telegraphy; F. M. Short, Cleveland, Ohio.

587,340 Operating alternating motors; C. P. Steinmetz, Lynn, Mass.—Consists in feeding alternating currents to one member of one such motor from a source of power supply, converting the energy so supplied to the motor partly into mechanical energy expended in driving a driven mechanism, and partly into electrical energy in the form of alternating currents induced in the secondary element of the motor, and supplying a second alternating motor with the said secondary currents.

587,343 Electric furnace; G. S. Strong, New York, N. Y.—The improvement in the art of electric smelting, which contists in forming electrodes of a mass of material including a material which will bind the mass together under pressure and simultaneously agglomerating, forming and feeding said mixture forward to a furnace by pressure.

587,379 Dynamo-electric machine; E. P. Warner, Chicago, Ill.—Consists of cores carrying the field coils, the pole-pieces connected therewith by two or more constructed necks or paths, said necks or paths being proportioned to carry the necessary lines of force of the main field when at practical saturation point to thereby prevent the passage of lines of force due to the armature coils.

587,405 Signal for telephone switchboards; C. E. Scribner, Chicago, Ill.—Two terminal plugs of a pair and the plug circuit thereof, means for connecting a generator of signaling current with one of the plugs, a bridge of the plug circuit, a source of current and a signal in the bridge, and another signal included in a conductor of the plug circuit between the said bridge and that plug with which the generator of signaling current may be connected.

587,406 Apparatus for telephone switchboards; C. E. Scribner, Chicago, Ill.

587,421 Electric arc lamp; S. Bergmann, New York, N. Y.

587,433 Electric signaling apparatus; M. Du Perow, Washington, D. C.

587,435 Automatic telephone system; M. Freudenberg, Paris, France.

587,436 Electro-therapeutic apparatus; F. Geiger, Philadelphia, Pa.—A main circuit, a patient or operator circuit; a fixed resistance in series with the operator circuit, and a variable resistance in the main circuit, and in shunt with the patient or operator circuit.

587,437 Apparatus for manufacturing chlorate of potash by electrolysis; Fer. Hurter, Liverpool, England—A cathode consisting of a metallic vessel having a porous protective lining.

587,441 Regulating apparatus for electrically driven machinery; W. H. Knight, Newton, Mass.

587,442 Method of regulating electrically driven mechanism; W. H. Knight, Newton, Mass.

587,438 Electric switch; H. W. Smith, Pittsfield, Mass.—Comprises a block, a tapering undercut recess therein, a contact plate bent to correspond substantially with said recess, and a pin within said recess to secure said plate in place.

587,465 Electric arc lamp; E. F. Taylor, West Chester, Pa.

587,467 Telephone central station signaling circuit; G. K. Thompson, Malden, Mass.

587,502 Central office switchboard system; W. S. Harrison, Chicago, Ill.

587,507 Electric signal device for elevators; O. Raacke, St. Louis, Mo.

587,531 Electric motor or dynamo-electric machine; R. Lundell, Brooklyn—An electric motor having a rotary armature and a field magnet composed of duplicate or interchangeable parts with overlapping field magnet poles surrounded by an energizing coil inclined at an angle to the axis of the armature and permitting of removal thereof without disturbing the field magnet.

587,534 Electrical alarm for cars; A. Nathan, New York, N. Y.

587,535 Electric signal box; A. T. Whittlesey, Cleveland, Ohio.

587,568 Electrolytic heating apparatus; G. D. Burton, Boston, Mass.—Consists of a tank provided with an electrode adapted to contact with the contents of the tank, with a second electrode adjacent to said tank, an adjustable rest adjacent to said second electrode.

587,576 Dynamo electric machine; C. M. Green, Cleveland, Ohio—Consists of a series of commutator rings, of armature coils connected with commutator segments at the same side of the armature at which the coils are located, and several sets of commutator brushes to engage said commutator rings.

587,591 Device for closing windows; H. I. Luyre, New York, N. Y.

587,594 Electric contact; A. J. Moxham, Lorain, Ohio—A metallic cover plate, having a perforation and upward projections on each side thereof, in combination with the contact secured in said perforation, but insulated from said projections.

587,614 Electric wire holder; C. J. Stram, Waterman, Ill.

587,642 Electric contact box; W. M. Brown, Johnstown, Pa.—Comprises a fixed contact and a contact-carrying armature, a spring encircling and secured to said armature and to a fixed portion of the mechanism.

587,649 Electrocution chair; E. F. Davis, West Caton, N. Y.—A chair having means for passing an electric current through a person seated therein, a foot rest, a seat registering the weight of an individual and an adjustable back.

587,663 Telautograph; G. S. Tiffany, Highland Park, Ill.

587,669 Burglar alarm system; W. T. Arnold, Chicago, Ill.

587,674 Electric railway; R. M. Hunter, Philadelphia, Pa.

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Tesla's System of Energy Transmission to a Distance Without Wires.

In view of the many reports which are appearing in the sensational dailies about Tesla's work, it appears only justice to this earnest and modest worker that we should publish the following sensible statement reported in such a competent and carefully edited journal as the *Sun*, of this city. The statement is reported as follows in its evening issue of August 4:

Nikola Tesla this morning denied the report that he had announced the completion of his discovery of a method of telegraphy without wires. Occasional reports of the progress of the work had been published from time to time, he said. His experiments had been repeatedly shown in strict confidence to some of his personal friends, but the publication of them in any detail must have been a violation of confidence. As a matter of fact, no experiments were made at the laboratory yesterday. The inventor, however, was willing to give some account of his work up to the present time.

"In a lecture delivered about four years ago," he said, "before the National Electric Light Association, in St. Louis—that was in March, 1893—I explained a certain scheme for producing electrical disturbances with the object of transmitting intelligible messages, and even power, from place to place without the use of any wires.

"The principle is this: An electrical oscillator is connected by one of its terminals to earth, and another is led to an insulated object of considerable bulk. This object should preferably be at a great height, where the air is less dense and transmits more easily the disturbance.

"Such an apparatus is then exactly what in mechanics would be a suction pump. Periodically it draws electricity out and forces it again into the earth, thereby altering rhythmically the electrostatic potential in the earth as well as in the air.

"This scheme I had, as a matter of fact, conceived many years before. But I had previously lacked the courage to present it to the scientific world. At the time of the St. Louis lecture I had already seen such results that I gathered courage enough to announce the project seriously.

"Shortly afterward, on my return to this city, I actually demonstrated by means of an improved apparatus that I was indeed able to create a disturbance in the manner described in the lecture.

"In my pleasure and excitement at this success, I could not refrain from showing the first experiments to a few intimate friends. When, later, my laboratory burned down, and the first instrument with which I had succeeded in my demonstration, and which I valued above any other, was destroyed, it was no small consolation to me that a few men whom I hold in high esteem had seen the first evidence of my success. They were my friends. Of course, all the experiments that I have made to this day have been shown only in confidence and with the express understanding that no popular publication should be made of them until I had acquainted the scientific world with my results.

"It appeared several years ago that the result I aimed at would be very difficult, if not impossible, to attain. The method, nevertheless, as I have outlined it, is simple, involving merely the use of a properly constructed oscillator connected with the ground, and with an elevated object; also a sensitive and properly adjusted receiver at a distance, similarly connected with the ground, and with an object at a considerable height. For the purposes of this receiver, I consider a balloon most suitable.

"These disturbances with which I am experimenting are produced by methods and devices which I have been perfecting more recently, and from present results I do not consider it at all impracticable to obtain, if such were desired, electric sparks a mile in length. They could be readily secured by apparatus designed on these novel lines. I now obtain sparks as long as eight feet, and can produce local disturbances. What I affirm is that the disturbances in this city may be made perceptible in London or throughout the world.

"The voltage is very high—beyond computation. For a wild guess I should place the voltage at 50,000,000. I have stood in the course of the sparks, but I consider them dangerous.

"Scientific results are what I have been chiefly interested in. But there are many possibilities of turning the methods to practical use. For instance, if I wished to make a fortune I should only have to take out patents on methods for exploding torpedoes or powder magazines at a distance by means of electrical disturbances produced in this manner. But to dispel popular and erroneous opinions on this point, it is appropriate to say that, whereas, it is perfectly possible to ignite an explosive by a suitably arranged apparatus at a distance, yet this fact will not revolutionize warfare. The enemy could avail himself of similar methods with like results."

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The Mayor and Gas Committee will receive bids to light the City of Waco, on an all-night and also on a moonlight schedule, with 125 to 200 arc lights, 2,000 c.-p., for a term of two to five years. We will also receive bids to install an electric light plant, specifications for which will be furnished by City Engineer on demand. All bids must be accompanied by a $1,000 certified check. We reserve the right to reject any or all bids. The bids will be opened by the Mayor and Gas Committee at 3 P. M., October 7th, 1897.

C. C. McCULLOCH,
Mayor, Waco, Texas.

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